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DILUVIUM;

— OR —

THE END OF THE WORLD.

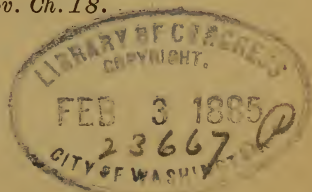
A. $\frac{1892.}{1889.}$ D.

— BY —

✓
GEORGE S. PIDGEON.

“He that answereth a matter before he heareth it, it is folly
and shame unto him.”—*Prov. Ch. 18.*

ST. LOUIS:
COMMERCIAL PRINTING CO.,
1885.



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COMMENDATIONS.

[From M. J. Howley, Auditor, City of Cairo, Ills.]

HON. GEO. S. PIDGEON.

Dear Sir:—From what I have read of your book "Diluvium," I can say it is highly interesting and instructive. It is well written and full of useful information. It cannot fail to interest every lover of books. It ought to become one of the most popular books of the day. I shall be glad to secure a copy when published.

Very Truly,

M. J. HOWLEY.

CAIRO, ILLS., Nov. 22d, 1884.

Something new. We have seen part of the manuscript copy of a book entitled "Diluvium." If one may infer the character of a book from reading a part, we can safely say it will be highly interesting and instructive. It is really something new, and will interest everyone. Entirely out of the beaten track, it presents a number of facts and views of a scientific cast, that are intensely interesting. We understand it is to be published in a few weeks.—*Cairo Bulletin*.

[From H. H. Candee, U.S. Commissioner.]

JUDGE G. S. PIDGEON.

CAIRO, ILLS., Nov. 18th, 1884.

Dear Sir:—I have looked over the list of contents of, and read extracts from, your forthcoming book entitled "Diluvium; or End of the World." It certainly is a remarkable production, and contains some theories calculated to startle the people of to-day. It will interest all, and should be generally read. You will enroll my name among your list of subscribers.

Yours Truly,

H. H. CANDEE.

[From Russell B. Griffin, Esq., of Sedalia, Mo.]

GEO. S. PIDGEON, Esq.

SEDALIA, MO., Nov. 15th, 1884.

Dear Sir:—After reading your work entitled "Diluvium," I can freely say that it is a remarkable and striking presentation of facts and theories in regard to questions of universal interest which I have ever met with before. The reasoning is sound, and the facts undisputed, as it appears to me. Your book will prove exceedingly popular and interesting. I shall again read it carefully through, when published, with the greatest pleasure.

Yours Respectfully,

RUSSELL B. GRIFFIN.

CAIRO, ILLS., Nov. 21st, 1884.

A new book—"Diluvium." We have seen a part of the manuscript of "Diluvium." It will prove intensely interesting to everybody, as it certainly concerns every one. When published we shall be certain to give it a reading, and advise everybody to go and do likewise.—*Argus Journal*, Nov. 21st, 1884.

[From D. T. Linegar, Member Ills. Gen'l Assembly.]

GEO. S. PIDGEON.

CAIRO, ILLS., Nov. 10th, 1884.

Dear Sir:—I have read the opening chapters of your book entitled "Diluvium; or End of the World;" your work is an interesting and timely discussion of a number of very interesting subjects, in which every one must have an interest, and can not well afford to neglect the opportunity of acquiring the information which your book will supply. The subjects presented are not only of general concern or interest, but are clearly and concisely stated in language well suited to popular reading, and will not fail to secure a large sale of the book.

Yours, etc.,

D. T. LINEGAR.

[From Judge R. S. Yocum, of Alexander Co., Ills.]

HON. GEO. S. PIDGEON.

ALEXANDER CO., ILLS., Nov. 22d, 1884.

Dear Sir:—I became deeply interested in reading your book "Diluvium; or End of the World." Although not an agreeable subject to contemplate, I found it fascinating and calculated to arouse the mind to its greatest activity. The fertility and plausibility of reasoning that produced the work is to be wondered at. Although based upon facts and generally accepted scientific theories, it is anything but dry reading, and can not fail to entertain all who read it, though they may not, in view of the date fixed, heartily accept the conclusions of the author.

Yours Very Truly,

R. S. YOCUM.

[From John M. Lansden, Att'y at Law, Cairo, Ills.]

HON. G. S. PIDGEON.

CAIRO, ILLS., Nov. 22d, 1884.

Dear Sir:—I have read a few chapters in manuscript of your forthcoming book entitled "Diluvium," and will say they have made it very evident that the quotation on the title page may be justly applied to him who, merely from observing the title, or noticing the subjects discussed, says that it is visionary or wholly speculative, or of no practical importance. The subject matter of the book may indeed invoke on the part of many, some such criticism, some such captious disposition of the book, and hence the propriety of confronting all such persons with the truth—that wise truth—that "he that answereth a matter before he heareth it, it is folly and shame unto him." I shall be glad to procure a copy of the work when it is published.

Yours Truly,

JOHN M. LANSDEN.



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PREFACE.

TO avoid misconception of the author, or his purpose, in presenting the following speculations to the public, he wishes to say that, though he has given somewhat of his time to a study of those natural sciences chiefly involved in a discussion of the theories herein presented, and of the conclusions drawn therefrom, he still recognizes his liability to err; but his convictions being that they were entirely consistent with those principles or natural laws which are ever without conflict or shadow of change or turning—as consistent, active and certain now as when first called into existence by the volition of an Omnipotent Creator—and that his conclusions were the necessary sequence of the premises—it seemed rather a duty than otherwise to present them for the consideration of others.

The author, as he conceives, bases his theories upon recognized principles and authenticated facts; his conclusions appear, at least to himself, as the necessary result of converting Sahara, the great African desert, into an inland sea, as now proposed, and as he believes will be done in the coming decade. Other than by this publication in book form, he knew of no effective method by which he could so well present his views to such as might be willing to consider them.

It is confessed that the title selected for this book is of a somewhat startling character, and may be calculated to awaken an interest in the work; but the reader is assured, the title has not been adopted, like the head-lines of a sensational story, as a mere decoy to entrap the unwary, but as a fair indication of what may be expected within. As to the sufficiency of the facts and proofs, and the reasonableness of the conclusions drawn therefrom, every one will form his or her own opinion.

He has given the subject such consideration as the facilities at command would enable him to do with reference to those cosmic and geographical changes in the earth which may be expected to

follow from so great a change of mass or matter from one section of the globe to another, being fully impressed with the truths of the several views and theories herein set forth. Our first intention was to communicate them to others through the medium of the weekly or monthly press; but finding any statements, however condensed, to greatly exceed our first expectations, we have written them out for publication in their present form.

In the observations and researches of writers upon physical science, we found so many facts which corroborate and strengthen our own conclusions as to the effect likely to follow the innundation of the great desert, our chief aim has been to select and present to the reader no more than enough to be fairly understood by all persons whose general knowledge fits them for a consideration of the views and reasoning presented.

Begging your pardon for one further digression from our subject, we wish to say it has not been without hesitation we present this work to the reader, because we foresaw some would say these theories as to the consequences likely to result from converting Sahara into an inland sea can not

be true, else why have not some of the very many eminent savans and writers of the day pointed out the great danger to be apprehended.

Again, others will feel as in the case of a person treading a doubtful path along the brink of a deep and dark abyss, who prefers not to look down or consider the probabilities and possible consequences of falling, or even have any one to point them out.

On the other hand, entertaining our present opinions, we felt to withhold them would make of us a sort of *particeps criminis*—or an accessory before the fact, to any event which, by timely notice, might have been prevented or avoided. And we felt, further, that this being a scientific question in no event could harm result by directing attention to it in season.

“Herr Vogel considers that the fear that an hypothesis or theory might do harm to science, is only justifiable in very rare cases; in most cases it will further science. In the first place, it draws attention of the reader to things which, but for the hypothesis, might have been neglected. Of course, if the reader is so strongly influenced that, in favor of the hypothesis, he

sees things which do not exist—and this may happen sometimes—science may for awhile be arrested in its progress; but in that case, the reader is far more to blame than the author of the hypothesis.

A. PROCTOR."

Whether, therefore, our theories provoke levity or serious and thoughtful consideration we give them, and leave others to say whether mistaken and fallacious, or true—or it may be only food for amusement—a literary condiment wherewith to season more substantial dishes.

If the illustrations in our work, or an occasional remark, would seem to indicate a want of appreciation of the importance of the subject, the author begs the reader not to attribute it to a lack of proper seriousness on his part, so much as to a disposition not to discount trouble before maturity by an undue and fruitless anxiety about future events wholly beyond his individual control, which would be in spirit, if not in the letter, contrary to the injunction that warns us against crying for spilled milk; or, to reverse the proverb, we say, don't worry about milk that must be spilled.

One feels a secret admiration of the philo-

sophic colored citizen who, a short time before his execution, was asked if he had any further request to make. Said he: "None, except a good water melon."

So far as our theories are new, or in conflict with received opinion, it is with due deference to superior knowledge and diffidence in our own ability, which might not have been overcome had we not felt encouraged by the reflection that, though knowledge is power, and wealth is power, truth is more potent still; whether kings or peasants, men of high renown or low degree, be the vehicle of communication, it is equally a part of divinity itself, and its reign on earth will have but begun when man and all his works have passed away.

We know not what reception our efforts shall meet with—whether they may stimulate further investigation or not. The announcement of a somewhat similar event on a former occasion did not. At that time, the general average of wickedness may have been higher, and the exceptions fewer, than now; but the present age can certainly show a large, very large, number of individual specimens that would have been good for

an anti-diluvian blue ribbon. Nor, we fear, are the exceptions as numerous as they ought to be.

We make no claim to an exhaustive discussion or treatise, or that our views have been presented as fully and forcibly as they might be. We have done, within the limits proposed, as well as we could. Others, if they choose, may do as much better as they can. If "the only impeccable authors are those who never wrote," we may not wholly escape, and do not object to any just and well-meant criticism.

Launching our little craft upon the sea of public favor, if the venture proves successful we may dispatch, at some future time, a second cargo of an improved quality.

Soliciting your kind indulgence, gentle reader, we are most sincerely yours, etc.,

THE AUTHOR.







CHAPTER I.

Introductory—Schemes for Inundating Sahara, the Great African Desert—M. De Lesseps—Time of Beginning and Completion—Doubters.

“To him who in the love of Nature holds
Communion with her visible forms—she speaks
A various language.”—*Bryant*.

PERHAPS, of the many interesting themes for our contemplation and improvement within the domain of natural science, none afford to a greater extent the opportunity of combining both pleasure and profit, interest and instruction, than those laws or forces which immediately concern the physical constitution and permanency of the globe we inhabit—the abiding place and heritage of man, during his natural life, as well as the habitation and home of the inferior races of animals over whom he has been given dominion and power.

The Creator has given to man a mind so organized that he may not only contemplate terrestrial phenomena with pleasure, but every manifestation of creative energy within the range of thought or vision. The starry heavens above; the earth beneath, and the varied and ever changing scenery upon its surface,—the last possessing the additional interest of being immediately connected with his own safety and existence. He has reasoning faculties by which he may ascertain and discover the laws or natural forces inherent or impressed upon matter from the beginning. The prolific source of incessant mutations of form and physical phenomena—he may control and use them to his advantage, or may, whether willfully or ignorantly, become the victim of self destruction.

The principle of gravitation is the foundation and corner stone upon which the earth reposes. It is this force in nature that enables man to stand, walk or run at will; to build houses; erect stately structures; and generally no act or operation necessary for his protection, comfort or happiness could be executed or done but for the constant force of this law in nature.

He may make it his most valuable and trusty servant, to do his bidding, or his most destructive and powerful enemy—as he shall wisely or unwisely invoke its power.

One person could easily at high tide make an opening for the admission of water through the dykes of Holland that all the men in Europe could not stop or fill until it had covered the country that is now protected by these levees.

The discovery of Sir Isaac Newton of the principle of gravity was the beginning of a new era in physical science; and as an effort of genius was equal, if not superior, to the tragedies of Shakespeare, Homer's Iliad or the frescoes of Michael Angelo.

A force constant and uniform in action, certain in results and universal in extent. It is the key to unlock the hidden geological mysteries of the earth, and the prophet to foretell coming events yet hidden from sight in the womb of time.

This law of gravity may be said to have been the proximate cause of cosmic convulsions at long intervals or geological ages apart, which have deluged the earth, and will again bring upon it a cataclysm that shall leave no historian to record the catastrophe.

Not only so, but it may be within the power of man to precipitate, prematurely, such an event (if anything ever so happens) and there is the highest degree of probability in the statement that such will be the case or fact within a few years from this time—a deduction believed to be fairly drawn and fully warranted from the facts and proofs given in the following pages.

A perusal of the contents of this volume will satisfy the doubter and convince the skeptic, who may question the possibility of such an event, not only of its possibility, but of a high degree of probability that such an occurrence within the time fixed will take place. Our expectations are not based upon any doubtful interpretation of prophecy, a revelation from heaven, or other supernatural sources of knowledge.

Neither do we invoke the assistance of any unknown or insufficiently established principle in nature; or that of any doubtful phenomena or questionable fact; but only such as are accepted by all well-informed persons. And reasoning from the effects—from the phenomena, upwards to the cause, the writer asserts the occurrence of such events in past geological periods as a fair and

reasonable deduction from telluric phenomena, as shown by the concurrent testimony of many eminent scientists and students of the present age; and he predicts a cataclysm, or end of the world, so far as animal life is concerned, as the necessary result of principles recognized by all as true and unquestionable.

Like causes always have and must always continue to produce the same or like results; nature's forces never tire or forget; energies are never lost but ever changing; mutability is written over the face of all things. In the future, as in the past, great events will serve as the landmarks of time—events exceeding in magnitude and consequence those preceding or following, as some lofty mountain-peak that rises far above the foot hills by which it is approached. As we recede from one such event we are nearing another; natural forces are constantly making alterations in the topography and structure of the earth; human agency, too, has and will still contribute in the production of structural changes. Man may set in motion natural forces wholly beyond subsequent control; he may release potential energies beneath whose mighty tread he would van-

ish as the dewdrop under a tropical sun ; he may open Pandora's box only to find himself powerless to re-imprison the evil genius which his temerity hath set at liberty. Nature's laws are no respecters of persons or numbers—observe no equities—whether the welfare of one or one million be involved, avails nothing. The scheme for inundating the desert of Sahara finds endorsement from English and French engineers ; it is a promising and plausible project, and has already taken possession of the public mind as the next great international work, which, in the interests of European commerce, will engage the attention of capital. It may not, therefore, be thought unreasonable to assume that within a few years this work will have been begun, and be pushed to an early completion. Upon this assumption we place the prediction of a paroxysmal and sudden abnormal movement of the globe, to be followed by a deluge or flood.

Projects for inundating large areas of the earth's surface, lying below sea level, have been at different times and are now proposed for the ostensible purpose of securing commercial and other advantages, which may be expected to fol-

low. The principal or chief project of this kind is the one for inundating the great African desert, Sahara, thereby converting that vast area into an inland sea by cutting a canal from the Gulf of Cabes, on the Mediterranean, into the Algerian arm of this desert.

“The project of submersion of large parts of the Sahara originated during the French geodetic survey, conducted by Capt. Roudaire. Capt. Roudaire was commissioned in 1874 to complete the topographical survey of the depression existing in the Sahara at Constantine, and he found upon the French territory an inundable space of 6,000 kilometers, which forms a part of the ancient Tritonitas Paulus, anciently communicating with the Mediterranean near Cabes.

HENRY DURVEYRIER.”

It is also proposed to admit the waters of the Atlantic Ocean by cutting through a narrow range of sand hills to *inundate* the western portion of Sahara, from the coast facing the Canary Islands, as far as the country of Asawad and Timbuctoo, covering an area of 126,000 square miles. In the light of modern progress and the marvelous accomplishments of the last

fifty years or half century, these projects will certainly be prosecuted and become accomplished events within a few years at most. The distinguished French engineer, M. De Lesseps, who is now engaged in the prosecution of even a more difficult and expensive work, so far as first cost is concerned—the Panama Canal across the Isthmus of Darien, which, it is said, will be opened for traffic by the year A. D. 1888—endorses these schemes for flooding the Sahara, and very likely will undertake them as soon as the work he is now engaged upon is completed or sufficiently advanced, unless his age shall prevent. If such should be the fact, then there are many other distinguished engineers, both in Europe and America, who would only be too glad to secure so great a distinction. Therefore we may reasonably expect that this work will begin as early as the fall of the year 1889, and will be finished or completed by the year A. D. 1892.

In the future, as it has been in times past, all great achievements will have their vicissitudes: the opposition of some; the adverse criticism of others; and their periods of progress and delay; but modern skill and capital have accomplished

works that were, but a few years since, regarded as visionary and utopian, until the possible achievements of engineering skill and combined capital can scarcely be foretold or limited. It is also true that unforeseen complications or causes may delay the beginning of this work for a season; but the restless and ambitious spirit of the age will not allow it to long remain forgotten.

Still other causes than those already enumerated will hasten the early consummation of this scheme: the English occupation of Egypt and the Soudan country; the interests of European nations now seeking to secure a share in African Colonization; and the trade with the country lying south of the desert.

By invitation of the German Empire, France, Portugal and other European powers, a conference of the nations and governments interested in the African commerce of the Congo River Valley has, recently (November, 1884) met in the city of Berlin to consider the settlement or territorial delimitation and other questions, in which the German Empire, England, France, Belgium, Portugal and other powers, including the United States, are deeply inter-

ested. To this Congo or West African Conference the United States have sent accredited representation. New and unexpected questions and differences may arise, which, before final determination, may be referred to future conferences or settled by diplomatic correspondence between the several governments having an interest in African colonization and commerce. When these questions and such complications or conflicting rights as may appear have been satisfactorily adjusted, then will there be an increased interest in and demand for a safer and speedier transit across the arid, trackless waste of Sahara—this desert lying, as it does, directly between the Mediterranean Sea and the Congo Valley—as well as other sections of Africa from which will come a large and growing commerce or trade in coffee, oils, ivory, gold dust and other valuable productions of equatorial Africa. The inundation of the desert of Sahara and the creation of an inland sea will be the least expensive and most practical, from a trade view of the situation. Our knowledge of the psychological relations existing between mind and the material world is not yet such as to admit of the same certainty in forecast-

ing future results in human affairs as in physical science; but we believe that historical analysis warrants the conclusion that, in every age mankind, without conscious intent, have moved toward the ultimate accomplishment of certain ends or results—towards a destiny enveloped and hidden from sight by the sombre drapery that divides the two great oceans of time, the past and the future, from each other. In the grand march towards this ultimate end, we may consider mankind as a unit, or single body, which, like a countless army, is moving forward in certain lines of thought and development. Towards these purposes and this destiny this body moves onward like the waters of the ocean, or some irresistible power that covers and overturns all barriers to its progress; in vain does the lookout shout “Danger ahoy!” the individual members of this body, the molecules of this unit, neither hear nor heed the cry. As an innumerable herd of stampeding animals, those in front cannot stop, nor those behind see the danger until too late.

Any attempt at a diversion of the column or change of direction is but opposing the inevitable and unalterable; this ultimate end or objective

is the consummation of purposes or desires growing out of the dominant thought characteristic of the particular age.

The inspiration of to-day is the prosecution and development of great schemes, such as tunneling mountains, opening oceanic canals, creating inland seas, and a materialism that sees not a potency or promise to any form or vestige of life, except in the conservation of force, and the incessant transmutations of matter.

We may, therefore, reasonably expect that by the year A. D. 1892 the waters of the Atlantic and Mediterranean, or of one of them, will fill this great African basin, the natural and probable result of which will be the fulfillment of the predictions herein—being no more than descriptive of those consequences or effects likely to follow the supposed antecedent conditions upon which they are predicated, in obedience to natural laws or forces, exact and certain, whether called into play by the movements of a world or an atom, the upheaval of a mountain or the fall of a leaf.

Upon the principles and canons of Newton, Kepler, La Place, and other scientists, we think the reasoning correct and the conclusions the necessary result.



CHAPTER II.

Extent of Sahara—Area below Sea-level—Tons Required to Fill the Desert—Weight of the Earth—Probable Change in the Earth's Planetary Position.

THE Desert of Sahara extends from the Red Sea on the east to the Atlantic Ocean on the west, and from the mountains of Berberia and Atlas on the north to the fertile and tropical regions of Negroland on the south side of the Tropic of Cancer. It covers 15° in latitude and 49° in longitude, and contains a total of over 8,500,000 square kilometers—an area larger than that covered by the United States of North America. The whole of this great desert is not below sea-level. A fraction of the included area consists of table-lands, low ranges of hills and mountains, such as the Wanyanga and Ahagger, and the mountains and table-land of Mourzouk, not generally of considerable eleva-

tion. The amount of area above and below sea-level cannot be given with exact precision, because of conflicting statements made by European engineers and travelers who have visited different sections of this desert, mostly lying on the north and west sides. But all agree that there is a large country embraced within its exterior boundaries lying below sea-level, believed to be much the largest part in extent.

A very considerable part of this desert is, to this day, more of a terra incognita than equatorial Africa. Even the wandering Arabs and the trading caravans that cross it keep to certain lines of travel and dare not venture beyond these lines of travel, keeping to the higher and more hospitable parts, where water and some scanty vegetation may be found, avoiding the lower levels and sandy waste that spreads out like an interminable sea in all directions. We may assume that most of the unexplored portions are the deeper parts of an ancient ocean-bed that once covered the whole land; and that the depth and area of the surface within this desert below sea-level is greater than any estimate that has hitherto been made. It was once a sea and

under water, as shown by water-lines, as well as the marine shells and fauna now found there. The measurements that have been made were not very remote from its border-lines. It is reasonable to expect the greatest depression within the interior and central parts.

Let us suppose that only one-fifteenth of the whole of this vast country, three thousand miles long and one thousand miles wide, extending from the Indian Ocean on the east to the Atlantic on the west, to be an average of 275 meters below sea-level; we then have an area of 560,000 square kilometers, or about 220,000 square miles, and to fill this basin would require 176,637,542,400,000 tons of water, or over 176 trillions tons weight. The inundable area may be more than twice as large as the above estimate. If such be the fact, a proportionally less depth below sea level would still require an equal quantity and weight of water to fill it to the present level.

As the estimated weight of the whole globe which we inhabit is 5,852 trillions of tons,* it will be seen that this body of water, to be taken

* Thos. Dick, LL.D.

equally from all other water surfaces of the earth and transferred by the force of gravitation to fill this great desert and convert it into an inland sea, constitutes a very large fraction of the whole mass and bulk of the earth. This would still be true, though it was but half so much as the foregoing estimate, but when we further consider that the transfer of this weight from where it is now to this new place of deposit would, as one of the immediate results of such transportation, raise the present sea level, until the mesa land and lower ranges would be below the new level, and therefore also covered with water. We can scarcely venture to fix a limit to the changes in Africa and Europe and the whole earth, and to its inhabitants, that might not follow.

That these changes and altered conditions would not proceed with slow and measured steps, but with an impetuosity and suddenness commensurate with the immensity of the work and natural forces brought into play. The earth would seek a new line of gravitation to place itself in harmony with all the external forces acting upon it as a member and part of the universe of created matter. In the erratic oscillations and

.

throes caused by contending forces her elements and the climatic conditions of different parts would be re-adjusted in their several relations to each other. The whole earth would be as a reed shaken in the wind.

Mankind has been endowed with reasoning faculties and the capacity to learn the operation and existence of those laws which govern the physical universe, and he has by the same power been given the freedom of choice whether he will so act as to promote and secure his own temporal welfare, or acting in disregard of such laws suffer the consequences. But whether the prosecution of so hazardous a scheme shall proceed may also, in ways that we do not now understand, depend upon the purposes of Him who, without interfering with or infringing upon the freedom of will, still shapes the destinies of men and sometimes leaves them to a disbelief or indifference that makes them the agents of their own destruction and punishment—the means to an end—the instruments in the divine economy for carrying out the purposes of Him whose perfections are incomprehensible and whose ways are past finding out.



CHAPTER III.

Cost of the Canal—The Panama Interoceanic Canal—Last Report of Progress—M. Fuchs—A Rising Sea Level—Principles of Gravitation—Position of the Earth in Space—Natural Phenomena Always Complex—Attraction of Matter.

WERE there no evil or injurious consequences to be apprehended in submerging the desert of Sahara, the commercial benefits which might be reasonably expected to follow would be greater in proportion to first cost than in the great work of uniting the Atlantic and Pacific Oceans by the Panama Canal.

The latter has been estimated to require the expenditure of as much as two hundred millions of dollars. The work is now being carried forward with great energy, having from ten to twenty thousand laborers constantly employed. An expenditure of more than fifty millions has already been made to this time.

The estimated cost of cutting a canal through from the Gulf of Cables to the Algerian arm of Sahara is 300,000,000 francs, or say about 60,000,000 of dollars. The waters of the Red Sea, the Mediterranean and the Atlantic might all be turned upon Sahara, by as many separate openings for less than the highest estimates for the completion of the Panama Canal, or any two of these for less than required to connect the Pacific and Gulf of Mexico by Capt. James B. Eads' ship railway.

So far as the required capital and labor are concerned it is a practical undertaking, and in the recurring periods of peace and general prosperity, when capital becomes redundant and confident, seeking investment in new and plausible schemes of commercial progress and development, there can be but slight doubt that this great project for making a vast inland sea of Sahara will be brought forward and pushed to completion, if not by M. de Lesseps, then by some other equally distinguished and ambitious engineer, seeking professional honors and *notoriety*. With the completion of the Panama Canal, as now proposed, by the year A. D. 1888, this will

be the next great international work to engage public attention. Capital, commercial supremacy, ambition and recklessness will all combine to promote the work, and then the beginning of the end will not be far away.

The last report of M. de Lesseps, made at a meeting of the shareholders in the Panama Inter-oceanic Canal, in Paris, July 23, 1884, showed a total expenditure up to June 30, 1883, of \$42,205,955. This report after stating the financial resources of the company to be in a satisfactory condition, and the amount of work yet to be done, concludes with the following statement:

“This is calculated to execute the whole of the dry excavations in three years, and the necessary dredging in two years. It therefore results that even if we had only commenced the work of dry excavation on January 1st, 1885, and the dredging on January 1st, 1886, the canal could be finished by mathematical calculation by January 1st, 1888.”

“To meet anything unforeseen, notwithstanding that the minimum yields just estimated have allowed for unforeseen accidents, we will have as a sort of margin all that will have been executed

in dry excavations up to January 1st, 1885, and all the dredging that may be accomplished up to January 1st, 1886, and in addition all of the year 1888. ”

It is also proposed to admit the waters of the Mediteranean from the Gulf of Sidra into the Libyan desert, which connects with and is but a part of the great African desert, Sahara. Whether this opening for the admission of the waters of the ocean into the desert be made from Sidra, Cables, or the west coast opposite the Canary islands, the ultimate effect and consequence must and will be the same. No insuperable difficulties are known or supposed to exist in either case. The distance from the Gulf of Cables to the Algerian arm of Sahara, is twenty kilometers. The land between the gulf and desert is of recent origin, consisting of alluvian sand and chalk formations. The last as an underlying sub-stratum.

“M. Fuchs found the breadth of the bank of chalk now shutting out the ancient bay Paulus Tritonitas to be twenty kilometers.”—*Johnson's Cyclopædia*.

The land lying between the desert and the Mediteranean Sea, and between the desert and the

Atlantic Ocean, being friable and free from metamorphic, basaltic or other hard rock formations, there would be no obstacle or barrier to prevent the immediate and rapid erosions of the bottom and sides of the opening or canal through which the water may be first admitted. It would, as we have seen, have a fall which would send the water through with such velocity as to rapidly deepen and widen the water way, increasing hourly in volume, velocity and power in the ratio of a geometrical progression.

To fill this desert to the present sea level would require an inconceivably great bulk and weight of water.

But this level would not remain stationary ; it would rise as the waters rushed in, and the whole desert, including the Mesa and higher ranges of hills, as well as the lower parts, become as it was in ancient days, a great sea ; this vast bulk and weight of water being drawn from the entire water surface of the globe and deposited in a new and different locality, must, if Nature's laws are unvarying and certain in their operation, produce not only climatic, but changes in the earth's equipoise in space, as well as great alterations in the present relations of matter.

The space previously occupied by the water which would enter and fill Sahara would be re-occupied by air, but as this element is 815 times lighter than water, it would furnish no considerable equivalent for the displacement. 814 parts of the whole or total weight would be just so much taken from one part or section of the globe and deposited in a new and different place on the earth's surface. The effect would be, not only to raise the sea level by a change in the centre of gravitation, but other cosmic changes would be equally and absolutely certain to follow.

The position of any object resting upon the surface of the earth is determined by the superior attraction of the earth. But the earth is a unit; has her own position in space as a member or part of the stellar universe determined by the gravitating forces from without. The present planetary position of the earth is due to and may be taken as the exact equivalent of all the forces in Nature tending to produce that result. One factor is the mass and present position of matter in the globe itself. Nor can the amount of such change be fixed or pre-determined by a comparison between the earth's total bulk and the amount

of such displacement. We have not the knowledge or means by which to calculate the precise present position of the earth's centre of celestial gravitations, and the direction and proportional relations between all external forces from without, as well as from within the solar system, the united efforts of all of them holding the earth on her present planetary position in her orbit.

In nature all phenomena are complex, and depend upon many causes which may cross and recross each other in many ways. To illustrate the idea, we may consider some of the more obvious forces and complex motions of the moon in its movements. It revolves upon its axis once in about 27 days, and in the same time around the earth, and again with the earth around the sun, and yet, again, with the earth and sun and all the planets round the foci of some still greater ellipse. How complex, how various the forces operating to move the solar system, every star of the millions that bedeck the dome of heaven contributing its share in the grand result. It may never be possible to resolve all gravitational force proceeding from millions of other worlds and our own, or determine the share and effect of each

separately combined, with reference to the earth. Speaking as to the moon, Prof. Chas. A. Young says: "We are compelled to admit one of three things: either the lunar theory is in some degree mathematically incomplete, and fails to represent accurately the gravitational action of the earth and sun, and other known heavenly bodies, upon her movements, or some unknown force other than the gravitational attractions of these bodies is operating in the case, or else finally the earth's rotational motion is more or less irregular, and so affects the time reckoning and confounds prediction. If the last is really the case, it is in some sense a most discouraging fact, necessarily putting a limit to the accuracy of all prediction until some other unchanging measure of time shall be found."

Therefore it may not be possible to foretell with accuracy and precision the direction or amount of terrestrial movement to be expected from the inundation of Sahara; but there is absolutely no uncertainty whatever in the uniform and ceaseless operation of those natural laws or forces which would be called into action by so doing.

Take a toy balloon filled with just enough hy-

drogen gas to support it; place it in a room where the air is at rest; now if the two centres coincide the balloon will remain at rest in whatever position it may be placed; but if the centre of gravity is nearest to one side, then this side or hemisphere will turn towards the earth. Now make the smallest addition to the upper or opposite side, so as to make that the heaviest, and it will at once take the place of the lowest hemisphere, each occupying the previous position of the other. As the child's toy, so the globe we inhabit is but a great balloon speeding its way through space at the rate of 68,000 miles per hour, in obedience to natural force and subject to the same universal law of attraction, and quite as sensitive to any change or alteration in the position and relations of matter composing its bulk as the other.

“In the case of bodies acted upon by more than a single force, the effect of each one is not thereby diminished. The resultant representing the total of the several forces, according to the second law of motion, a given force will produce the same effect whether the body on which it acts is in motion or at rest—whether it is acted upon by

that force alone, or by others at the same time.”
—ELROY M. AVERY, *Physics*.

“The problem of any number of bodies moving under their mutual attraction, according to the Newtonian laws, stands from a physical point of view on precisely the same footing as that of *two* bodies, given the masses and the positions and velocities corresponding to any moment of time. Then the whole configuration of the system for all time past and future (*abstracting outside influences, of course*) is absolutely determinate and amenable to calculation. But while in the case of two bodies the calculation is easy and feasible by methods known for two hundred years, our analysis has not yet mastered the general problem for more than two.”—PROF. CHAS. A. YOUNG, *Scientific Monthly*, Nov., 1884.

All bodies throughout the universe attract and are attracted by each other in proportion to quantity, and inversely as the square of the distances. The position of the earth in its orbit is determined by gravitation, and since the sun, or even the whole of the solar system, is not more than a small fraction of the total mass of matter distributed throughout infinite space, the positions of the

earth in her orbit must be taken as the resultant of all the forces acting upon it.

It is not attracted or drawn equally in all directions, nor can we suppose the sun to exert the total of external force. He is but the satellite of some greater body, around which the planets and asteroids, as so many moons, attend this solar centre in his great orbit, and the solar system but a fraction of the whole of created matter. Now if by the transfer and change of matter from one place to another, that hemisphere which was lightest becomes the heavier, and the centre of gravity is moved from its present position, then there must of necessity be a readjustment of planetary position. The amount of matter thus changed is but one factor or element in determining the amount of movement or the direction it would take from such displacement.





CHAPTER IV.

Diagram of the Earth—Lines of Gravity—Change of the Ecliptic—Emergence and Submergence of the Land Surface—Solar Influence—Results.

IT cannot be supposed that we might take a segment of the globe, comprising about one-thirty-fifth of its total bulk and weight,

NOTE.

On page 45, third line, instead of *one-thirty-fifth* read *one hundred and seventy-six trillions of tons weight (176,000,000,000,000)*.



CHAPTER IV.

Diagram of the Earth—Lines of Gravity—Change of the Ecliptic—Emergence and Submergence of the Land Surface—Solar Influence—Results.

IT cannot be supposed that we might take a segment of the globe, comprising about one-thirty-fifth of its total bulk and weight, from one side, and transfer it to the opposite side, without disturbing the condition and present position of the earth in its orbit, and the relations of its constituent elements. If not, it is immaterial whether this change was instant or gradual; the effect must be the same and would follow in the same order of time; but if the earth's position, as a planet, would be affected at all by such a change of mass, then it would be with the rapidity with which matter will seek its level, or equilibrium, and a resulting new posi-

tion when out of equipoise with external forces. As the force of gravity is a constant force, the earth would find its new position in the plane of the ecliptic, with the velocity of a falling body.

Prof. Chas. A. Young, of pending astronomical problems, says:

“Another problem of terrestrial astronomy relates to the constancy of the position of the earth’s axis in the globe. Just as a *displacement* of matter upon the *surface* or in the interior of the earth would produce changes in the time of rotation, so also would they cause corresponding alterations in the position of the axis and in the places of the poles. The only question is whether they are so minute as to defy detection. It is easy to see that any such displacements of the earth’s axis will be indicated by changes in the latitudes of observatories. If, for instance, the pole were moved a hundred feet from its present position toward the continent of Europe, the latitude of European observatories would be increased about one second.

“The only observational evidence of such movement of the pole thus far is found in the results obtained by Nyren, in reducing the determina-

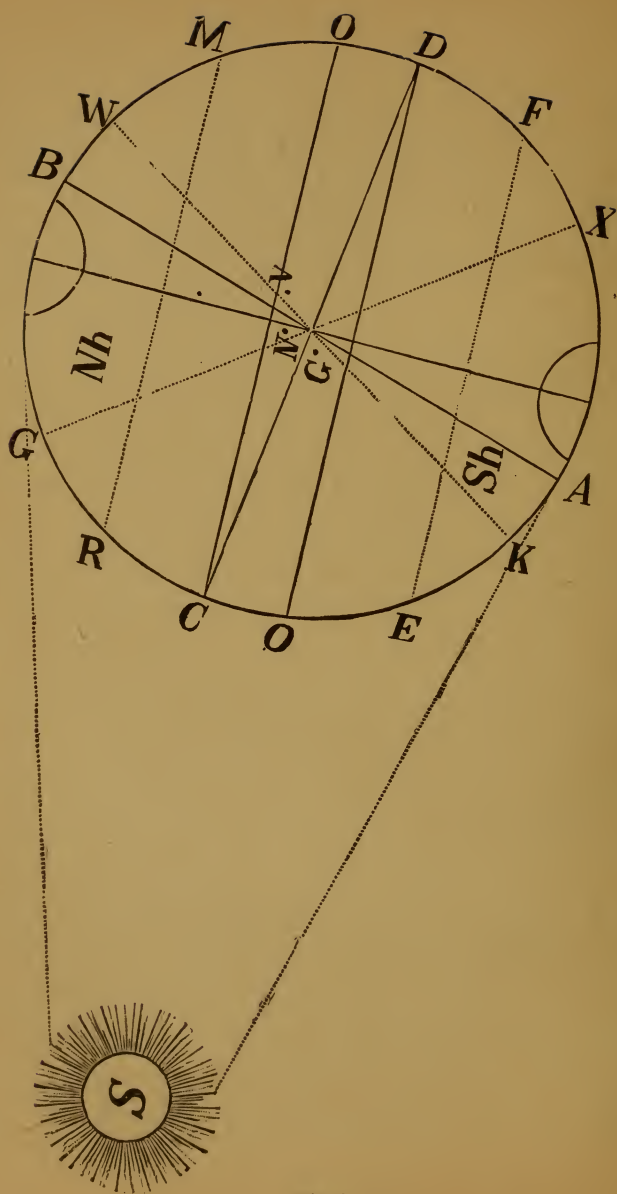


Fig. 1.

tions of the latitude of Pulkowa, made with the great vertical circle during the last twenty-five years. They seem to show a steady diminution of the latitude of this observatory—as if the pole were drifting away and increasing its distance from Pulkowa at the rate of about a foot a year.”

Let the globe, fig. 1, represent the earth; *Nh* the northern hemisphere; *Sh* the southern hemisphere; the intersection of the lines *CD* and *BA* the centre of the earth; *N* the centre of gravity; *CD* the equator; *OO* the tropics; *M* the position of the desert. Now, if we draw from the water surface of both hemispheres, say 175 trillions of tons of water, or sufficient to fill the desert depressions to the present sea level, the centre of gravity will be moved in the direction of *V*, or towards this desert. But as the sea level would rise in the same ratio as the centre moves, the bulk and weight of displacement would be proportionally greater than the estimate. The gravitating line would undergo no change; that is, its direction, considered apart from the matter or materials of which the earth is composed, and therefore the

earth must move round, or otherwise alter its position, until its new centre of gravity is brought into harmony with all of the external forces acting upon it. If this movement should be south or southeast, or southwest 25° , then the inclination of the axis would be 48° , and the equatorial line would move to GX . The surface now under the poles would be at K and W . The extremes of heat and cold in the Arctic and Antarctic would be greater; the range would be greater; the width of the torrid belt doubled. Such a change of inclination would not only be followed by the emergence of land now covered, and the submergence of other parts by water, but there would be a new ecliptic and new track through space in which the earth would move round the sun. How many and how great the various changes which would result from such an alteration of the earth's inclination in the plane of the ecliptic may be somewhat speculative. It may not be doubted they would be many, and challenge the most exuberant in imagination to describe or forecast. The supposed movement of 25 degrees is only given to illustrate a possible movement of the earth. The

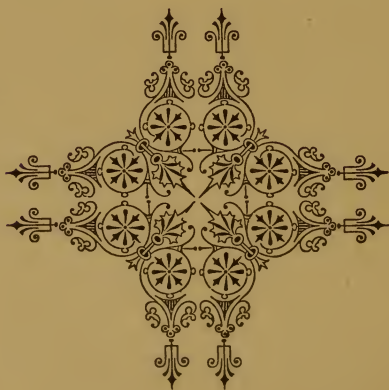
change might be more or less, or amount to a complete inversion of the poles.

The sun wields a controlling power over the planets within the solar system—greater than that of any other single body. It is the principal source of light and heat, the primary cause of rotary motion, as well as a large part of the phenomena observed upon the earth's surface ; but it is not the only or exclusive source of gravitating force. If it were so, the earth's axis would be and always remain vertical to the plane of the ecliptic.

The sun and all other bodies, both within and without the solar constellation, act upon, and determine by their joint attraction the inclination of the earth's axis. It is but the resultant of all external force as applied to the earth and the molecules composing its bulk in their present relations to each other. If their present relation and position be altered, there must follow a corresponding change in the angle of inclination of the axis and all lines of latitude and longitude.

All the climatic and physical changes which would follow may not easily be foretold, more than they would be many and very great.

Those places now under or near the equator would be nearer the poles, whilst those parts near the poles would become the temperate or equatorial regions ; and Greenland might again, as it has unquestionably been once before, become a land of tropical animals and vegetation.



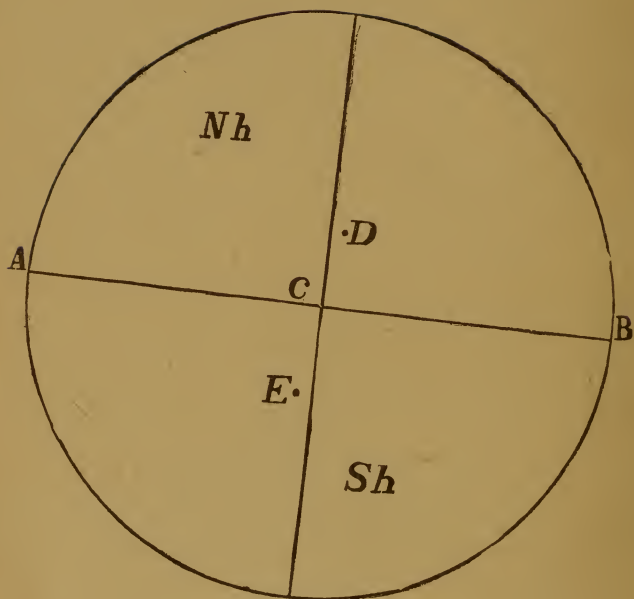
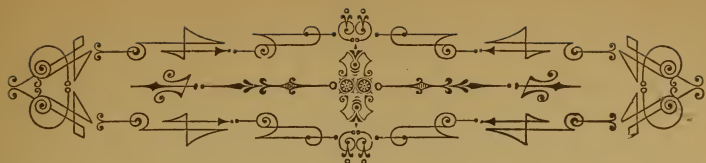


Fig. 2.



CHAPTER V.

Equatorial Plane—Centre of Gravity in the Northern and
Southern Hemispheres—Centre of Gravity Between the Two
—The Position of this Centre—Probabilities.

THE plane of the equator divides the earth into two hemispheres equal in dimensions or size but not in weight. If we find the centre of gravity for each of these hemispheres separately, and connect them by a straight line, the centre of gravity common to both will be at some point on this line, nearer to the gravitating centre in the hemisphere of greatest weight.

Let Fig. 2 represent the earth divided into two equal hemispheres by the line AB . Let D represent the centre of gravity in the hemisphere Nh , and E the centre of gravity in Sh , and C the centre of gravity common to both; the distance EC will be to the distance CD as the weight

of the hemisphere Sh is to the weight of the hemisphere Nh . Hence we have $EC : CD :: Sh : Nh$. Therefore the earth's center of gravity will be on the side of the plane of the earth's transverse axis containing the greatest weight, which side will be turned towards that part of the celestial globe from which proceeds the greatest exterior attraction, modified by the several forces and movements of the earth, or towards its centre of gravity as a part of the total of all matter within the universe. Now, if by the withdrawal of a portion of the water or weight as now situated in the northern and southern hemispheres, and placing it upon that part of the globe embraced within the limits of the desert of Sahara, the side Nh becomes the heavier; then Nh would assume the position of Sh , and Sh that of Nh . How small a displacement and deposit would have such an effect depends upon the present difference between the two sections, which may be less than the weight displaced and required to fill the desert. But should it be that the centre of gravity is now upon the side of Nh , there would still result a terrestrial movement exactly proportional to such increased weight. If

the centre should be changed from *Sh* to *Nh*, the position of the hemispheres would be reversed, each assuming the previous position of the other.

In the discussion of another question, that is, whether there is or is not an appreciable difference in the length of the solar day, which as yet seems an unsolved question—in regard to a change in the velocity of the earth's rotation upon her axis, and thereby a difference in the length of a solar day.—Professor Charles A. Young, in the *Scientific Monthly* for November, 1884, says : “ It has long been perceived, of course, that any changes in the earth's form or dimensions must alter the length of the day. The displacement of the earth's surface or strata by earthquakes, or by more gradual elevations and subsidence, the transportation of matter toward or from the equator by rivers or ocean currents, the accumulation or removal of ice in the polar regions or on mountain tops, the friction of tides and trade winds, any such causes must necessarily produce a real effect. But it has been supposed that these effects were compensatory and so minute as to be beyond the reach of observation. It is now questioned whether they are or are not.”

In any paroxysmal movement or general disturbance of the earth from any cause, the water of the oceans would remain upon its surface. (The specific gravity of water being less than that of the earth solids.) In the terrible violence of its movements and currents during such convulsions, the water would submerge the land, crossing and re-crossing the higher elevations of the globe. Any considerable sudden abnormal movement would also change the topography or figure of the earth, elevating the sea bottom and depressing the land. The present sea bottom would become the dry land surface, whilst the land now above sea level would be submerged and become the ocean bottom of the new epoch in the world's history.

The total weight of the earth in tons has been estimated at 5,852 trillions of tons, and the amount of water required to fill the desert up to the present sea level at 176 trillions of tons, a considerable fraction of the whole weight of the globe, but the power or tendency of a given weight to move about a common centre of gravity increases as the squares of the distances from that centre. Take the earth's centre of gravity

as a fulcrum. The power of a given weight to move round the centre increases as the squares of the distances, 1000 tons at 1000 miles from the earth's centre would exert 100 times the power that the same weight would at 100 miles or one tenth of the distance. Again we must double our estimate of the power which would be exerted by a given addition of weight to a particular section, because this weight has been subtracted or removed from opposite parts of the earth, equally distant from the common centre, it would be as if an amount twice as large had been added over a limited area from some independant source.

If a wandering asteroid or body having a bulk and weight equal to twice the mass and weight of water required to fill Sahara, should suddenly fall upon the earth's surface, it would most certainly occasion a paroxysmal convulsion of the earth.

If we further consider the certainty of a proportional raising of the sea level, and thereby adding several times as much more to the total of displacement, it must be apparent to those able to fully comprehend the magnitude of such changes and the principles which will govern, that any

estimate of probabilities by a comparison of areas and quantities will lead to mistaken conclusions of the most serious kind.

Three-fourths of the surface of the earth is covered by water. The oceans have a depth of from three to six miles, sufficient to more than cover the entire globe to a depth of three miles. The elevations of the land when compared to the bulk of the earth is not equal to the thickness of the skin of an apple to the apple, and we can perceive how slight a movement comparatively would carry the oceans over the highest mountains. If the earth was suddenly moved or checked in its normal movements in space, the possibility of such a catastrophe is not so remote as we might suppose.

The valleys and table lands, rolling hills and mountain ranges, indeed every part of the land surface of the world, is filled with many and forcible proofs that such things have happened in the ages gone by. Cataclysms that, whilst destroying all life or animate existence, and changing the outer form and face of Nature, have prepared at each successive recurrence or period the earth for a new and higher order of living

creatures than those previously existing. The wisest of men has said: "The thing which hath been, is also that which shall be."

We may not understand the thoughts and purposes of the Infinite Wisdom, that hath created all things and fixed the bound of duration, but we may scan the book of Nature and from her records obtain a better and broader view of future possibilities.

The testimony of the rocks, as well as other phenomena found upon the earth, point to and corroborate the theory, that at remote and widely separated periods in the past the earth has been suddenly, as the twinkling of an eye, moved from its previous position. The inclination of its axis changed its zones, poles and other lines moved, followed by a cataclysm, covering continents and islands and uncovering others in its paroxysms.





CHAPTER VI.

Physical Changes—The Desert of Sahara Formerly a Sea—The
Lost Atlantis—Great Continent of the South Pacific Ocean—
Islands of Polynesia.

ALL of the habitable parts of the globe furnish proofs of the many and vast changes which have occurred in past ages—continents and oceans alternately taking the places of each other, whether by gradual elevation and depression, or sudden convulsions—can be now only matter for speculation and conjecture. It is most probable the greatest of such changes have occurred before the earth was inhabited by man, or even the lowest orders of life. Many thousands, perhaps millions, of years ago a long tropical arm of the sea extended from the Gulf of Mexico over the western plains and mountains before the Rockies had attained their present heights. There were islands in these seas cov-

ered with semi-tropical firs, palmettos, willows and other trees. Along these islands walked some of the most gigantic forms the world has ever seen—huge dinosaurs, fifty to eighty feet in length, and many other remarkable animals, such as crocodiles, tortoises, fishes and mammals. Their remains are found for hundreds of miles along the flanks of the mountains, imbedded in strata of shale and sand-stone. The climate was warm and uniform, as attested by the flora and fauna of a warm tropical sea, which occupied the western prairies and plains from the Gulf of Mexico over the Wasatch range. The animals of the Jurassic age were of great size, some feeding upon the abundant vegetation, others, such as the creosaurus, were flesh eaters. — PROF. A. LAKES, in *Scientific American Supplement*, 1879.

According to Sir Charles Lyell, Sahara was a sea and under water between latitude 15° and 30° north during the glacial period, so that there was continuous water communication between the southern part of the Mediteranean and the Atlantic, now bounded by the west coast of Africa. This large area is now a sandy waste, much of it lying below sea-level, whilst other land surface

in other parts of the world have disappeared beneath the sea.

The continent of Atlantis disappeared beneath the Atlantic Ocean. Of this continent so little is known that its former existence is regarded, by some, as doubtful. We believe future explorations and researches will not only show its former existence as a dry land surface, but satisfactory evidence of its sudden immersion. They will most probably disclose proofs of the fact that when this continent was above the water there was still another continent, as large as Asia and Europe, situated in the southern hemisphere, where now rolls the South Pacific Ocean. The numerous groups of islands in Polynesia are but the higher elevations and peaks of a great continent that once lay far above the water by which it was surrounded. Within this continent there may also have been large deserts or depressions below sea-level, as we now find them in Africa, separated, perhaps, by narrow sand and chalk ridges from the ocean, which has by a tidal wave or earthquake, or an artificial canal, found an opening into the interior, which rapidly enlarging, has poured the waters of the ocean into them,

thereby changing the normal or previously existing conditions, disturbing the earth's centre of gravity and equipoise in space, and introducing all the varied changes which such an event might be supposed the immediate cause of, including the extinction of animals and the beginning of a new geological epoch.

If the event occurred by the opening of a canal to reclaim waste land and facilitate commercial intercourse, it may be that deep dredging will bring to light some evidence of the former existence of these antediluvians. It is, however, most likely that the water found its way through some opening made by nature, rather than that it was the work of the inhabitants of the country.

The interest of archæologists has been awakened by the recent discovery of curious ruins, statues and carved figures of larger size on Easter island in the middle of the Pacific ocean, twenty-five hundred miles west of the west coast of South America. The discovery was made by the officers of the German gunboat *Hyena*, on a voyage from Valparaiso to the Samoan islands. The vessel stopped at Easter island on her voyage,

and during the stay her officers explored it, and collected many relics, and made sketches of the large carved images which could not be brought away. The present inhabitants are entirely ignorant of the history of these interesting ruins, and have no traditions of the intelligent and cultivated race who occupied the island before them and have disappeared. Why Easter island alone, of all the myriad islands in that vast ocean, should possess such ruins? who were the people that built them? whence they came? and in what catastrophe they perished—are questions that force themselves upon us, without giving a clew to the answer. Probably the Easter island ruins were the work of the same race as that which built the ruined temples and carved the broken images of Yucatan; and when we shall have learned something about the one, we will know something of the other.





CHAPTER VII.

Physics—The Earth's Equipoise—Aerolites—Objects in View—
Commercial Benefits—San Francisco *Chronicle*—Area—Fallacies—Mississippi River—Dynamics.

IT is said the blow of a hammer will move the earth, or an atom the equipoise of a globe; but if this atom be taken from the opposite side of the same globe it is as though double the weight had been added from some other source. To fill the African desert requires the removal from other parts of the water surface of the globe of thousands of billions of tons weight, and this weight being also taken from places at the greatest possible distance from the earth's centre, its power to change the equipoise of the earth and its position in space will be proportionately increased, or as the square of the distances from the centre, that is, at the distance of four thousand miles, the radius of the earth, it will be

sixteen times as great as if placed only one thousand miles from the centre.

A disturbed or broken equipoise will occur as readily in the case of a larger globe or body as a small one, under like conditions.

Dr. Kane says: "Nothing can be more imposing than the rotation of a berg. I have often watched one rocking its earth-stained sides in steadily deepening curves, as if gathering energy for some desperate gymnastic feat, and then turning itself slowly over in a monster somersault, and vibrating as its head rose in the new element like a leviathan shaking the water from its crest. It was impossible not to have suggestions thrust upon me of their agency in modifying the geological disposition of the earth's surface."

These icebergs breaking away from the glaciers of Greenland, as they slowly push their way down to the sea, are carried by the winds in a southerly direction where, meeting with the warmer water of the gulf stream, the under parts are melted faster than those above water, until the base, growing too small for the superstructure, the line of gravitation in the oscillations of the mass falls beyond, and there is an immediate

inversion or change of position. The berg's line of gravity is determined by the superior size and attraction of the earth, and the freedom of its motions are also affected and restrained by the viscosity and friction of the water. The same natural laws apply to the earth ; its centre of gravity is fixed by the total of attraction from without ; its motions as well as position in its orbit are the result of external force applied to its mass as now distributed about its actual centre. Change any one or more of these factors and a new centre and other physical alterations must follow. The berg is surrounded by a fluid that, more or less, affects the freedom of its movements ; the earth is hung in space and is retarded by no friction of parts in responding to the slightest change of any character. As the kaleidoscope presents a new combination with every change, so will the earth with every material alteration in the position of its elements.

With many there is a vague, undefined impression that the earth is rigidly held in place and made to revolve by natural forces that would be unaffected by either more or less resistance. The earth is associated with the idea of firmness and solidity,

whereas nothing is more easily disturbed by natural causes. Tidal waves that occasionally occur, as in the Pacific a few years since, when large ships were transported a mile inland ; or the great tide on the English Coast, caused possibly by the near approach of some large body in its passage through the heavens ; these being beyond our atmosphere are not luminous, or passing in the shadow of the earth are unobserved. One was seen in the year 1879, a dark mass that rapidly receded from telescopic view. In such cases the effect is proportional to size, and nearness causing a momentary check or lurch of the earth, and raises a tidal wave that moves on until it breaks on some distant shore. After the passage of such a body the earth resumes its normal state and motion in these cases, whilst both bodies are affected relatively in proportion to quantity, yet not sufficiently so to bring them in contact.

Though no one questions the existence and operation of natural law, or its application to the movements of the earth as well as to any lesser body, yet some may suppose that so vast and ponderous a body as the globe we inhabit could only undergo such changes by imperceptible de-

grees, requiring ages to complete. The greatness of the earth only appearing by comparison with ourselves or other small objects upon its surface, when we regard the superior size of some of the planets and myriads of other celestial bodies in other parts of the heavens, it appears by comparison as insignificant in bulk as a molecule beside a mountain.

It is also true that the magnitude of an event, or the interminable and disastrous consequences and evils with which it may be fraught to man and the lower animals, has no effect upon the operation of natural law. Great revolutions and changes in nature occur usually only at long intervals of time apart, and serve to mark the beginning and end of an age. During the present century stars of great size and brilliancy have suddenly disappeared from the firmament, as though disrupted and scattered through space; large fragments or aerolites have fallen upon the earth's surface, whilst thousands composed of lighter and more combustible material have been consumed owing to their velocity and friction in passing through the earth's atmospheric envelope, all of them but parts of some celestial wreck,

proofs and evidence of the great forces that exist potentially, and in many instances requiring but the feeble touch of some insignificant hand to change this latent force into the kinetic energy of universal destruction.

Though mankind should not, by their own hand, precipitate a deluge, there are in operation natural forces which, at long intervals, have and will again bring upon the earth a cataclysm marking the end of one geological age and the beginning of another. We observe that the North Pole is constantly turned toward the north star, or the same part of the heavens. The small annual change of 50 seconds may be due to the gradual transfer of water to the Southern Hemisphere.

The Northern Hemisphere contains three-fourths of the land surface of the globe, and has an average elevation above sea level of more than 2,500 feet. It would therefore seem that the centre of gravity is at some point within the Northern Hemisphere; but notwithstanding this fact the water of the earth, which is the only element upon its surface sufficiently mobile to move under the slightest pressure, is constantly tending towards the South Pole, and that whilst the sea

level is rising there it is steadily falling in the north, giving to the land the appearance of gradual elevation. Marine shells, so fresh and perfect as to be fit for a collection of curios, may be now had along the California coast, hundreds of feet above the present level.

About nine-tenths of the debris from the land which is carried or washed down by rivers, is by rivers of the northern hemisphere, and is there deposited upon the sea bottom. When these movements of the land and water shall continue to a certain point, and the heavier side or hemisphere of the earth shall be opposed to the line or side of greatest attraction from without the solar system, being a line in the direction of the earth's axis indefinitely extended, the gravitating balance or equipoise will change the earth's position and there may be an immediate reversal of the poles. The major part of the land may then be in the northern hemisphere, or what is now the southern hemisphere. It may be thousands of years before such an event will again occur from natural causes; but of this none may know. Such knowledge being withheld from mortal man, he cannot weigh the hemispheres as in a balance,

and if without the means of accurately locating the earth's centre of gravity, or the annual displacement of land and water, and therefore without the data from which to fix the time of such an event in the future, he may none the more question the steady and ceaseless transfer of matter, or the consequences which will surely follow in the course of future events.

History does not more certainly repeat itself than nature; how wide the interval; how long from one repetition to another may be proportional to the magnitude and character of the phenomena. There seems in the life of animals a period proportional to bulk—the butterfly and the elephant, the pansy and the oak, seem to live a period having about the same proportional relations as their bodies. And great physical changes are usually followed by equally great intervals of repose. If floods have visited the earth, the evidence is germain to the question of whether it may not again be deluged, with like results.

If the French nation and such others as may favor the project for making an inland sea of Sahara should not be apprehensive of any great danger, there is but slight doubt of the prosecu-

tion of the work in the interest of commerce at an early day.

All great undertakings have, after being proposed, required a longer or shorter period for the discussion of the various questions bearing upon them, also time to crystalize into active measures the purposes of its projection, as well as to secure the needed financial support.

The proposition to convert Sahara into an inland sea has been under discussion for several years, and has received many commendations and criticisms in the current news literature of the day. With few exceptions, attention has been directed only to the cost and commercial advantages likely to result from so important a work. We take the following from a late issue of the *San Francisco Chronicle* :

“FLOODING DESERTS.—For some years, ever since the French got a footing in the valley of the Niger with a view to the colonization and annexation of Senegambia as an African province of France, French engineers have been encouraging a scheme for a canal to be cut from the Mediterranean across the outer rim of the Great African Desert, with the object of flooding it,

and transforming a now arid area, almost as large as the whole of California, into an inland sea. The underlying purpose was, and perhaps is yet, to open navigation to vessels from the Mediterranean to the nearest point of approach of the Niger valley to the Sahara. The project caused a good deal of loose conjecture and talk about the probable consequences of flooding so large a tract on the temperature of Southern and even Northern Europe, which is now in part regulated by the hot winds from the desert, of course tempered by their passage across the Mediterranean, but still much warmer, especially in the winter, than it is supposed they would be if the desert temperature were lowered from its mean of about 96° Fahrenheit, to that of the water, say 60° to 65°. We remember to have heard a very highly educated German remark on this subject, some six years ago, that if the desert were flooded, one result would be a fall in the mean temperature of Northern Europe that would render a large region bordering on the North and Baltic seas, now highly cultivated, uninhabitable, or not much better adapted to human, animal or vegetable life than Iceland or the north of Nor-

way and Finland." — *San Francisco Chronicle*, July 15, 1884.

The projectors of the several schemes for flooding Sahara have each had in view only particular purposes to be served and parts to be flooded; but as all these parts are connected, and constitute but a single great area below sea-level, having local names for different sections, the admission of the ocean at any one place would be followed by the same result, practically, as though separate canals were at the same time opened from Cables, Sidra, and opposite the Canary Islands.

The whole of the innundable part of Sahara, supposing the water to rise no higher than the present sea-level, is several times larger than the State of California. The entire area of the desert contains over three millions of square miles, or about one-sixteenth of all the dry land surface in the whole world.

Some newspaper writers have exhibited a remarkable want of knowledge of the physics and natural forces which would be brought into play by cutting a canal and turning the ocean into the desert of Sahara. Some have attempted to show

by calculations and figures that the capacity of a certain-sized opening or canal would not fill the desert with water in hundreds or even thousands of years, and the scheme, for this reason, an impracticable one. Such calculations have been based upon the idea of a trapezoidal canal or water-way, of permanent regime, carrying a stream of uniform depth, width and velocity. Such calculations may be approximately or exactly correct, so far as the quantity of water which such a canal would discharge in a given time and velocity; for these are but arithmetical calculations, which any one may make; but the premises (that the width, depth and velocity of such an opening or stream would continue uniform or permanent) is misleading, and the conclusion mistaken. It is an assumption wholly at variance with the principles in hydronamics.

The Mississippi river, with a fall of about four inches to the mile, its crooked and constantly changing course, acquires a velocity of five to six miles, sufficient to carry mud and gravel sediment and all lighter material in suspension. This river has been made to deepen its own channel at the South Pass by cutting through a hard-pan

bottom, until there is now thirty feet of water where before there was but half as much or less.

Were this river to flow from Cairo to the Gulf through a straight channel, whose sides were equi-distant and parallel, no steamer could possibly stem the current, but would be carried before it into the Gulf of Mexico. It would scour its bottom, carrying sand, gravel, quaternary rock, or other impedimenta, before it, and deposit the detritus in the deep basin of the Gulf.

It is sufficient to look at any great river, with rapid current and cutting banks, in order to notice the incessant mobility of the sides and bottom under the action of running water.

A canal intended to let the sea flow into the desert would be as direct as possible, and upon the admission of the water it would rapidly widen and deepen by its own kinetic force, the channel carrying the material displaced before it with irresistible power, with a fall of say fifty to one hundred meters in a distance of only twenty kilometers. The distance in which the total fall would occur would rapidly diminish from the desert towards the sea, whilst the head or fall would remain the same, until in

a very short time the entire fall would occur in less than in a single mile. The volume and velocity would increase with the rapidity of a geometrical proportion; unlike a swollen stream, which rapidly reduces its head and supply, the great ocean would throw itself into the breach, not indeed into the contracted limits of a narrow quadrangular channel, but a vast, moving arm of the sea, before which the primitive rocks would present but an inefficient barrier. With the whole ocean as a reservoir, the sea-level rising as the flood sweeps onward, the torrential character and terrible roar of the rushing waters could be likened to nothing since the time when the fountains of the great deep were broken up and the waters prevailed over the earth, rising fifteen cubits above the mountain-tops.

There is no history of any event in modern times from which we might by comparison obtain an idea of the greatness and grandeur of the movement upon land and sea; but as an illustration of the force and effect of water bursting through its banks, may be mentioned an example that occurred many years ago in the town of Glover, in Vermont: A lake, one and a half

miles long, half as wide, and one hundred and fifty feet deep, was drained by an opening cut for that purpose. The water rushing out urged its way down Barton river twenty miles, to Lake Memphramagog, mostly through a forest, cutting a ravine forty rods wide, fifty to sixty feet deep, inundating the low lands, and depositing thereon vast quantities of timber.

The lacustrine surfaces in Finland, occupying different levels, admit of draining from one to another, and by this means the Finns increase the area of tillable land. The work of nature is occasionally assisted by the hand of man in reclaiming fertile tracts. By skillfully directing the course of streams, the Finns thus add greatly to their domain, continually altering the aspect of the land. The engineers are, however, occasionally deceived in calculating the strength of the retaining dykes by which the waters are kept back, as in the case of Lake Hoyteainen, north of Jansen, in East Finland. For the purpose of gradually lowering the waters of this basin, whose level was 70 feet above that of Lake Pyhaselka, a ditch 10 feet broad was begun in 1854, and soon changed to a mean-

dering stream by the rains and melting snows; but on August 3, 1859, the dikes intended to regulate the overflow suddenly gave way, followed by a rush of water and a roar that was heard at Jansen, six miles off. The destructive inundation lasted three days, during which time Lake Saima, recipient of the overflow, was so agitated that the craft navigating its waters could scarcely resist the violence of its waves. The discharge was estimated at 3,662,000,000 cubic yards, or somewhat over 14,400 cubic yards per second, which was about the quantity discharged by the Rhine and Danube combined. The amount of solid matter carried down represented at least 46,000,000 cubic yards, forming a large delta in Lake Pyhaselka.*

In 1818, the waters of the Dranse, in Switzerland, having been long obstructed by ice, bursting through the barrier, produced still greater desolation. Such comparisons give but a faint and inadequate idea, and are something like an attempt to understand infinity by force of numbers.

* Elisee Reclus.

That the inundation of Sahara would be followed by great physical disturbances, of the most marked and violent character, co-extensive with the earth's surface, if not with the entire mass and framework of the globe, is as reasonably certain as any future event, and would be the second cataclysm since man was first placed upon the earth, and commanded to multiply and replenish the earth and to have dominion over it. The bow of promise—that God would himself no more destroy the earth by a flood—may be understood as not including any prohibition on the part of a restless and perverse generation from acting in criminal disregard of those natural laws which a wise and beneficent creator has impressed upon nature for their improvement and benefit, and of the existence and operation of which they may be said to have had timely notice.

As the sunshine and the rain descend alike upon the just and the unjust, so, like these, the errors and mistakes of some involve the many in the same calamities as themselves. Should such catastrophe occur, all will meet a common fate; nor will anyone stand upon the order of his going.



CHAPTER VIII.

La Place—Nebular Theory of Cosmic Origin—Thermic Changes
—Great Year—Noah's Flood.

THE nebular theory of LaPlace, as to the origin or beginning of the world we inhabit, is now accepted as the most natural and consistent, and that since the earth was first detached or thrown off from the sun, and began revolving in her orbit around that body, the outer crust has been gradually cooling. If this theory be true, and it be also true that the angle of the earth's axis to the plane of the ecliptic has remained stationary or nearly so, then there never was a time when it was colder in any given locality upon the earth's surface than it is to-day. It may have been warmer than now from the slow radiation of terrestrial heat ; but we know there has been alternating periods of heat and cold over the same parts of the earth's surface since

that time, and we must account for these changes in one of two ways—either the position of the poles has been changed very gradually, requiring thousands of years to complete the cycle, or it has been changed by operation of natural causes, suddenly, and without premonition, subjecting the mass to paroxysmal convulsions, such as would necessarily accompany such a movement.

To account for alternating periods of heat and refrigeration over the same parts of the earth by ascribing it to thermic changes, due to a gradual alteration of position, requiring many thousands of years, might be sufficiently satisfactory were it not that there are other geological phenomena connected with these changes inconsistent with the truth of such a hypothesis and such infinitesimally slow processes.

The great year of 21,500 years of 365 days each would produce an alteration of heat and cold over different parts of the earth. Glaciers after being formed might transport earthy matter and rocks. Fossil remains might be covered or uncovered by the slow action of the elements, requiring centuries to add to or take from the land

a single inch in depth. Geological revolutions, with slow and measured steps, have certainly made many physical changes. But there still remain facts which cannot be thus accounted for, situations that could not thus occur, conditions that could not be except as the result of diluvial movements which must have been caused by sudden changes in the inclination of the earth's axis to the plane of the ecliptic.

Any considerable sudden movement of the earth's axis would, of necessity, be followed by a paroxysm, and this by a flood or deluge of the land. We have a brief historical account of one such movement of the waters since the earth has been occupied by existing races, but prehistoric evidence derived from the physical features of the existing land surface of the earth furnish very strong grounds for saying that each geological period in the history of the earth has had its convulsions and floods, the cause being a change in the earth's axis or angle of inclination, as also in respect to the matter composing the mass. Naturalists have felt the need of accounting for existing phenomena, and have ascribed much to glaciers, volcanoes and earthquakes, sometimes

assigning to a mere effect the importance of a first cause.

The last flood which visited the earth came since it was peopled by man and existing races of animals. It was not universal, but partial; some parts of the earth escaped the rushing waters and the destruction which followed. A remnant of all existing races survived the disaster. The historical account is such as would be expected, as the first attempt at written history, made ages after the event; but with the physical indicia of the flood still fresh, it was only the historical recognition of a natural verity.

We think the Mosaic account of the last or Noachian flood in respect to events preceding or following the flood should be taken as simply the first written narrative of facts and events, a knowledge of which had been before that time preserved by tradition. Between the occurrences and the time when they were committed to writing, there intervened, perhaps, many ages, during which this knowledge was changed and varied in its details, the people being ignorant, superstitious, and without even knowing how to reckon time—but of the principal fact, the

great central truth contained in the Mosaic account, we feel assured, that is, that ages after man's appearance as an inhabitant, and when the world had grown populous and filled with the habitations of men, there was a flood by which they were suddenly cut off and destroyed. It is probable also that mankind have inhabited the earth much longer than the time fixed by any written account. This seems, from prehistoric evidence, as entirely reasonable. It is probable that ages came and went long before man had made sufficient progress in learning to so much as transmit by tradition to his descendants a knowledge of important events. As man increased, and the demands of his nature required improved methods and an improved vocabulary, he began to possess a traditional knowledge of past events. Whatever may be said as to chronological differences and discrepancies between geology and the Mosaic account of creation, we doubt not the fact that there was a great flood, and the destruction of much the greater part of all living creatures then upon the earth. In all ages natural laws have been the same and the records of nature are true. Our in-

terpretation may be wrong, but of this we may be certain—all truth is consistent, however diverse the sources from which it comes, or to which it belongs. Any true hypothesis must be consistent, not only with the immediate causes and results, but in harmony with every other phase or condition of matter. Theories accounting for some, but inconsistent with the existence of other phenomena, cannot be true.





CHAPTER IX.

The Last Flood—Chinese Antiquity—Asia—The Earth's Axis—
Former Position—Mammalia—Glaciers—Coal Measures.

ALTHOUGH telluric phenomena plainly indicates that at some remote period since the world was inhabited by man a great flood and convulsion of nature, caused by a sudden change in the position of the earth's axis to the plane of the ecliptic, and that the aqueous covering of the globe has rolled over and across the dry land surfaces of the earth, it would seem that the very high table lands of Asiatic Russia suffered less than other parts, and a part of the tops and sides of the mountain ranges of Amenia escaped inundation. Mt. Ararat is 17,000 feet above sea level, its top covered with perpetual snow.

If at the time of this last inundation or deluge there remained one-third, or 5,000 to 6,000 feet, of

the upper part above water, such persons and such animals as might have been upon, or could reach, the higher ground would have escaped.

Some facts furnished by geological authorities indicate a high degree of probability and truth in respect to the Chinese claim of great antiquity, reaching far beyond any period given by modern or ancient chronological tables. Archibald Geikie says:

“A curious fact deserves to be noticed during the convulsions by which the sediments of the Silurian sea floor were crumpled up, crystalized and elevated into land, the area of Russia seems to have remained nearly unaffected. Not only so, but the same immunity from violent disturbance has prevailed over that vast territory during all subsequent geological periods. The Ural Mountains on the east have served again and again as a line of relief, and have been from time to time ridged up anew. The German domains on the west have likewise suffered extreme convulsion, but the wide, intervening plateau of Russia has, apparently, always maintained its flatness, either as a sea bottom or as terrestrial plains. As I have already remarked, there has

been a remarkable persistence alike in exposure to and immunity from terrestrial disturbances. Areas that lay along lines of weakness have suffered repeatedly in successive geological revolutions, while tracks outside of these regions of convulsions have simply moved quietly up or down without material placcation or fracture.'—
ARCHIBALD GEIKIE, LL.D., F.R.S., etc.

If, as it would seem, some of the most elevated points of Armenia and the great plateaus of Asia, including the western parts or more of the Chinese Empire, escaped submersion in the Noachian flood, the claim to an uninterrupted succession for nearly 20,000 years, made by the Chinese, may be true.

It appears from prehistoric fossil remains, found in the eastern and western continent, as also from recent explorations in South America, that the earth has been inhabited by man for even a much longer time than is claimed for Chinese antiquity.

In digging into the ruins at Uxmal, in South America, Professor Augustus Plungeon found it to be the site of three successive cities, each, like the Troy Mound, investigated by Professor

Schliemann, marking a separate and distinct era and a different people. The uppermost and latest ruins indicate a rude and primitive race, far behind the one whose traces are found lower down, in the arts of civilization. The deeper ruins consist of idols and carved stones, some of them bearing hieroglyphics, more neatly executed and fresher than those on the monuments in Egypt.

At Chichen Itza, where the ruins cover several square miles, he found stones bearing astronomical characters, some of the constellations and fixed stars, and he suggests that, from the relative position of these, the figures must have been made 19,000 years ago. The earth was inhabited long before these hieroglyphics were cut in stone. Perhaps further observational investigation of the environments of these ancient relics will throw some light upon the catastrophe by which these cities were covered up and destroyed, whether by convulsions followed by submersion, or volcanic eruptions without inundation.

A disturbance of the earth's equilibrium by contraction, or the transfer of weight from one section or hemisphere to another, must have been

the immediate cause of the last deluge of the earth.

A volume of water sufficient to change the normal condition and raise the sea level above the mountain tops, could not have been held in suspension since the earth became a fit habitation for man, or subsequently evaporated within one hundred and fifty days. The immediate cause of the last flood was because "the fountains of the great deep were broken up." The earth's equilibrium was disturbed, and, as a consequence, she moved to a new line of gravitation and a new inclination of her axis of motion, which before, probably, was nearly or quite vertical to the plane of the ecliptic.

Northern America and England were previously nearer the north pole; India and Palestine were further away than now, and possessed a semi-tropical climate, which was nearly uniform the year round, and without so great a change of season as now. Vegetation grew without cessation. Huge mammalia and reptiles inhabited the torrid zone, whose remains are now found encased in the deposits in which they were entombed.

When the earth's axis assumed its present position of $23\frac{1}{2}$ degrees, then commenced the change of season which we now have, and man was then promised that "whilst the earth remaineth seed time and harvest, cold and heat, summer and winter, day and night shall not cease." Seed time and harvest and the change of season being the result of the procession of the equinoxes and the present inclination of $23\frac{1}{2}$ degrees, it may be inferred that this was the beginning of a new rather than the continuation of an old condition. It is readily perceived that, should the earth's axis assume a greater inclination than now, the changes would be still greater between summer and winter, the earth's surface subjected to much greater alterations in temperature and rendered less fit for the abode of large tropical animals. A considerable change of this kind would be followed by a general diminution in the size of the animals inhabiting the earth. Only the hardiest could withstand the great change between winter and summer that must occur annually. Our condition would be somewhat like that of Venus—the inclination of the axis of this planet is about 75 degrees; her tropical and fri-

gid zones extend over 150 degrees of latitude—so that the largest part of her surface is subjected to alternate periods of intense heat, followed by intense cold—changes wholly incompatible with the growth of large animals and luxuriant vegetation.

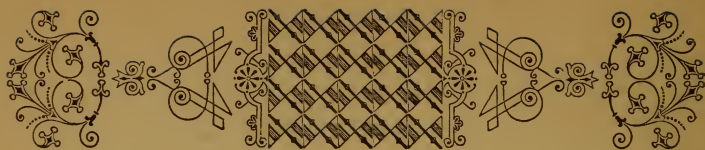
A change of inclination in the earth's axis of motion alone would not alter the relative distances of different parts to the poles, but the position of this axis in respect to the matter composing the globe would also be proportionately changed from its previous position, such a movement being the effect of a composition of all the contending impulses acting upon the earth at the moment.

The revolution of the earth about its shortest diameter is the cause and not the effect of its spheroidal form; a change in its axis of motion would cause a depression at the new poles and a filling out where they were before.

A considerable change in the location of the poles would produce a convulsion, and give the earth's mass and topography somewhat the appearance of having been put into a sack, well shaken, and then poured out again.

Upon the hypothesis that the world has experienced a deluge at the beginning and end of each geological period, since the eocene epoch, we can account for glacial periods in parts of the earth where now nothing remains but the evidences of their former existence ; for finding the fossil remains and well preserved specimens of huge tropical animals in high northern latitudes ; for the vast coal measures ; for the denudation of some and the submersion of other sections of the surface, as well as scores of situations and natural phenomena which confound and bewilder the geological student.





CHAPTER X.

Climatal Changes—Glacial Systems—Age of Ice—Earth's Centre of Gravity Changed by—Inversion of the Poles.

PARTS of the earth now within the frigid were once within the torrid zone, and sections now torrid or temperate were once within or near the arctic and antarctic circles. Of this there is no doubt, the question being whether these changes were slow, requiring thousands or even millions of years; or sudden, as when the equipoise of a ball is changed it seeks a new line of gravitation. In our opinion it was the latter, and that the geological record left by such movements establishes the truth of this hypothesis.

The Duke of Argyle says: "We are accustomed to associate the geographical position of Greenland with extreme cold; but the rocks of

Greenland tell us that, although this is the case now, it was not so in former ages. . But the curiosity of this contrast between the present and the past, as regards climatal conditions, is nothing to the still greater contrast in this matter which is presented by finding the same fossil flora in the rocks of Greenland—rocks whose surfaces are now almost wholly bare of vegetation, and all the higher elevations of which are covered with eternal ice and snow. The flora of the coal measures has certainly flourished on the area now occupied by Greenland.”—*Good Words*, April, 1884.

“Two great glacial systems are recognized, the eastern and western. The former extended from Southern Canada to the Mississippi River, and as far south as Kentucky. The Catskill Mountains have been striated; the markings are very fresh—no rock marks could be more so. These markings are 2,800 feet above the sea, showing the ice to have been 3,000 feet thick. * * The sides of the second canon of the Colorado River are glaciated from bottom to top. These walls are 1,000 feet high—the glacier was 1,700 feet thick. Salt Lake was covered with ice; musk-ox

bones are found there. This was an arctic animal."—ARCHIBALD GEIKIE, LL.D., F.R.S.

The remains of glaciers are found to the present day in California and Oregon, as far south as Yosemite Valley, and without doubt at no remote period might have been found in Sonora and Chihuahua, Mexico.

The nebulus theory of the origin of the earth being accepted, and that it has been gradually losing heat, it would be colder now in any given place in the temperate zones than at any former period; and if the earth's axis has always inclined $23\frac{1}{2}$ degrees to the plane of the ecliptic, as it now does, it could never be that mountains of ice and arctic animals only existed where now blossoms the magnolia and the orange, and other semi-tropical fruits and flowers. So, too, Iceland and Greenland have once had a warm climate, rich in tropical fruits and fragrant flowers—where now perpetual winter reigns, with only icebergs, polar bears and the remains of an occasional arctic expedition. The south pole has experienced the same thermal changes and vicissitudes.

“ This change of climate is one of the most perplexing problems of geology. That a different

distribution of land and water and ocean currents may have contributed to the former climactic conditions of the arctic regions is probable. Astronomical conditions connected with the changes in the eccentricity of the earth's orbit have also been suggested as a cause, and finally it has been supposed that a somewhat different chemical composition of the atmosphere prevailing cooperated with geographical conditions to maintain the peculiarly mild climate, which, so far as we can judge, prevailed throughout the arctic regions in Paleozoic times."—*American Encyclopedia*.

It must be evident that this change of climate, due to alterations of temperature over the same parts of the earth, will continue to be one of the most perplexing of geological questions, until the true hypothesis or key to unlock these apparent difficulties and contradictions shall be found. Professor H. B. Norton, recognizing the objections to the many and perplexing theories in the field, presents one which seemed to him to present a better solution of the question, and consistent with the thermic changes that have taken place, as well as other phenomena connected with

such changes. The learned lecturer and author seems to have caught a glimpse of the true theory, but passed around and away from it, by presenting as the most rational explanation of the various phenomena due to such changes the very slow movement of fifty seconds annually of the earth's axis, and the consequent varying angle to the line of the apsides, requiring more than 20,000 years to return to the same point. In respect to this line he says in his lecture entitled "The Age of Ice": "Ancient moraines, striations and clay beds, evidently of glacial origin, testify that at some period not very remote, as we count geological periods, the whole northern hemisphere down to 40 degrees N. latitude was submerged and covered with vast glaciers. There is not a scientist of eminence who questions this assertion. * * A favorite theory is that of vertical elevation; but it seems impossible to admit that a circle enclosed within the parallel of 40 degrees, some 7,000 miles in diameter, could have been elevated to such a height as to produce this remarkable result. This would be a hard supposition to reconcile with the present proportion of land and water on

the surface of the globe, and with the phenomena of terrestrial contraction and gravitation. Moreover it seems that an extensive submergence was one of the features of the glacial age. The frozen archipelago called Greenland is a fair picture of what Northern America and Europe must have been at that time, and of course this precludes the idea of elevation. If it were not true that submergence and a great lowering of temperature occurred simultaneously, we might imagine that a sort of undulation in the earth's crust, alternately raising and lowering each portion of it, could have caused this result. There is, however, no evidence that such an undulatory motion ever occurred, and we cannot conceive of any force likely to produce it." * *

"The antarctic continent is an ice-cap nearly circular in form, about 3,000 miles in diameter; unexplored and uninhabitable, we cannot easily ascertain its thickness. The arctic ice-cap is much smaller, and is honey-combed by the Kuro Siva and the Gulf Stream. Nevertheless, the Greenland archipelago seems covered with glaciers often several thousand feet in depth. If we assign to the antarctic ice-cap a thickness of 15,000 feet, we have

a mass of ice large enough to displace the earth's centre of gravity a mile to the southward of its centre. A gradual displacement of this sort, caused by the slow accumulation of ice, would produce an imperceptible drainage of the oceans from north to south—the gradual emergence of northern and the submergence of southern continents. If we examine the globe we seem to discover an actual result of this sort. The greatest mass of the ocean is gathered about the south pole; the northern hemisphere includes five-sixths of the land surface of the globe. Moreover, geologists affirm that this inequality is increasing; they assert that the northern continents are slowly rising, and the islands of the South Pacific sinking. It is more probable the water is slowly draining away from the north to the south and accumulating in the southern hemisphere.

“I have assumed an arctic ice cap of 15,000 feet thickness, and a displacement of the earth's centre of gravity one mile toward the north, at the height of the glacial age. It is not necessary to assume any such amount of displacement. If the earth's centre of gravity coincided with its centre, so as to equalize the amount of water in

the southern and northern hemispheres, Itasca Lake would not be more than 600 feet above sea level. Now push the centre of gravity 2,000 feet towards the north, and the Arctic Ocean would be so much deeper over the pole, and the water would be about 1,000 feet deeper in latitude 45 degrees. To accomplish this result we must calculate that the space within the arctic circle was covered by an ice cap averaging 8,000 feet in thickness—an entirely supposable case. Such an amount of displacement would flood all the low lands of North America down to the line of 40 degrees. It thus seems there have been many glacial periods in each hemisphere; that the earth, like a mighty pendulum, vibrates from pole to pole through vast but regular periods.”—*Scientific American*, *Sup. No. 200*, 1879.

It is thus Professor Norton, and those who agree with him, propose by what seems a plausible theory, to account for thermic changes and glacial periods over different parts of the earth, now embraced within the temperate zones; and to account for these slow accumulations of ice, first at one pole and then at the other, it is asserted that the line of the apsides or major axis

of the earth is not fixed with respect to other bodies in space, but that it is slowly revolving in the direction that the earth moves in its orbit. The axis of the earth having a gyratory motion of 50 seconds annually, requires a period of 21,000 years to make a complete revolution, and return to the same position in respect to the major axis of the ecliptic. That the variations of the ellipticity of the earth's orbit causes a corresponding difference in the length of the summer and winter seasons of the northern and southern hemispheres; that at this time the summer of the northern half of the globe is eight days longer than that in the southern hemisphere, it follows that the winter season in the southern hemisphere is now eight days longer than that in the northern hemisphere, making a total difference between the two of sixteen days. That this being now the long winter of the southern hemisphere, glaciers and ice are now forming in winter faster than it is melting in summer, consequently there is a gradual increase in bulk about the south pole, a corresponding change of the earth's centre of gravity and lowering of the sea level north; thus these periods of refrigeration alternate between the poles dur-

ing a period of 10,500 years, when the maximum of severity or cold is reached, the oceans submerge the land, and glaciers and icebergs form as far as 40 degrees north or south latitude in whatever hemisphere the long winter prevails at the time.

The waters of the southern hemisphere are being drained southward, and during the long winter of the great year the ice accumulates slowly but surely, changing the earth's centre of gravity southward. It is probable that when it passes south of the equatorial plane, there may be a disturbed equilibrium, and an immediate inversion of the poles toward that part of the universe from whence proceed the greatest exterior attraction. The earth will constantly present that hemisphere containing the greatest weight, which is probably at present the northern hemisphere, this containing five-sixths of the land surface, having an average elevation of over two thousand five hundred feet above sea level. The earth constantly presents the arctic circle or north pole to the same part of the stellar universe, just as the moon constantly presents the same side to the earth, this being the side containing

the greatest weight, because the earth exerts a controlling force or attraction over that body.

Slow and imperceptible change, caused by the gyratory motion of the earth's axis, may account for alternations of heat and cold at the poles, and consequently for the formation of glaciers; but there remains phenomena inseparable from these changes, of which this alone does not seem to be the immediate cause.

We think it likely natural forces are in constant operation, which at long intervals of time bring about a disturbed equilibrium by gradual transfer of matter from one hemisphere to the other, and are followed by cosmic convulsions and floods.

There has been, since the earth lowered its temperature sufficient to admit of being inhabited by living creatures, beginning with the lower orders, great floods, the immediate effect or result of a change in the earth's centre of gravity, diluvial convulsions marking the end of one epoch and the beginning of another. This hypothesis will account for phenomena which cannot be otherwise explained, and seems consistent with all recognized facts in geology.

It will best account for finding the fossil remains of the mastodon, elephant, rhinoceros, hippopotamus, tigers, cave bears, hyenas, and the bones and implements of prehistoric man, preserved in high northern latitudes and in caves and gravel beds. Natural agents, such as wind, rain, frost, cyclones and volcanoes, have also wrought great changes in the unwinding of the ages, but all these have their insignia or ear marks not to be mistaken for those of a cataclysm, nor those of the latter for glacial action on the sedimentation of quiet seas, and the fluvatile deposits of rivers.

“The oolitic rocks are remarkable for the variety of organic remains they contain. The animal remains are those belonging to the land and to fresh water. The teeth and bones of fish and reptiles are abundant. The reptiles are mostly saurian animals and turtles. Among these are the megalosaurus, the plesiosaurus and the iguanodon, some of which must have been at least 70 feet in length and of the height of an elephant. There are also vegetable fossils in these rocks, consisting of arborescent forms, trunks of paleous gigantic reeds and similar vegetable productions, which are now to be found

growing only in the torrid zone.”—THOS. DICK, LL.D., *Geology*, p. 70.

“The bones and skeletons of large animals, and especially the mammoth, are found in diluvial gravel in many countries. In Siberia the tusks of the fossil elephant are found in the diluvial banks of almost every river, and sometimes in such abundance that the ivory from these skeletons is an article of export.

“It is said that the skeleton of a whale lies on the top of mountains 3,000 feet high on the coast of the northern ocean which could scarcely have been conveyed to such an elevation but by an immense overwhelming deluge.”—THOS. DICK, LL.D., *Geology*, p. 71.





CHAPTER XI.

Former Epochs and Floods—Natural Agents—Erratic Rocks—
Sudden Changes—Norwegian Theory.

THE several destructions and new arrangements of the material composing the earth, which the eminent astronomer and physicist, Dr. Thos. Dick, supposed to have taken place in the past, must have been in consequence of terrestrial movement, caused by either a gradual or sudden displacement of the earth's centre of gravity. The same causes are still at work and in time must produce similar results ; but it is also possible for man to precipitate a greater or less convulsion of the earth by facilitating the displacement of matter upon the earth's surface.

Volcanic action, however great, does not create any material alteration of position in matter, and hence does not effect the centre of gravity, but a change of mass from one section to another must have this effect.

The convulsions that have marked the end of one geological age and the beginning of another were the immediate result of a sudden alteration of position due to gravitation. That any sudden change of position would be followed by great floods hardly admits of a doubt.

We regard, as some of the effects and present proof of such occurrences in the past, the fact that different parts of the earth's surface have had periods of great heat, followed by an age of extreme cold; that tropical animals are now found in the arctic regions, fully preserved; the movement of immense erratic rocks hundreds of miles, and to higher levels; the fossil remains of marine animals far in land, and to great heights above sea level, as well as finding the remains of man and all kinds of quadrupeds, and the bones of whales and other marine and land animals occupying a common burial ground at great depths, in drift beds and caves; and to the same immediate cause the formation of all the principal coal measures of each geological age, the deposit of boulders and boulder clay, as well as other phenomena, much of which is ascribed to glacial action—a favorite theory, and used to

account for generally whatever does not appear to have been certainly caused by heat, contraction or volcanoes, this being considered the residuary share of ice, icebergs and glaciers.

England, Europe and America have in the past experienced periods of great refrigeration, when icebergs and glaciers existed, as they now do, within the arctic and antarctic circles. Most scientists accepting this hypothesis have constructed the further theory that most of the physical features of those countries are due to glacial action. If a valley has been filled, a mountain or hillside striated, or a ridge of gravel and clay deposited, glaciers did it; if a sea bottom was ridged, or a channel scoured, it was done by a glacier of the right size and depth, with underhanging rocks, like the diamond in a glass cutter, ready to do the work; if great, angular stones and rounded boulders were transported hundreds of miles, either up or down grade, by land or water, across wide valleys or mountain ridges, it is the irrepressible glacier that did it.

“Some of the blocks of stone with which the surfaces of glaciers are loaded, falling occasionally through fissures in the ice, yet fixed and

frozen into the bottom of the moving mass, and are pushed along under it; in this position, being subjected to great pressure, they scoop out long, rectilinear furrows or grooves parallel to each other on the adjacent solid rocks. Smaller scratches and striæ are made on the polished surface by crystals or projecting edges of the hardest minerals, just as a diamond cuts glass.”—*Antiquity of Man*, p. 231.

It seems to us that a much larger share in the dispersion of erratic rocks has been given to glacial action than any observational fact or analogical reasoning will warrant or support. A glacier is an immense body of ice and snow formed by slow accretions, and, when moved, must proceed with the lines of the mountains and valleys, and not obliquely or at right angles to them; yet such was often the direction of these lost rocks.

“In Massachusetts the direction taken by the drift, as shown by a multitude of examples, varied from north and south to northwest and southeast. This carried the current very obliquely across most of the precipitous ridges of mountains in the State. Nevertheless the boulders held on in the general direction with re-

markable uniformity. In the western part of Massachusetts the mountains are from one to three thousand feet high, yet vast quantities of boulders have been carried over these ridges.”—EDW. HITCHCOCK, *Geology*, p. 238.

In the eastern continent there are many similar instances—rocks of immense size broken off and carried hundreds of miles; and thousands of smaller ones still further. The most natural supposition must be that deluvial forces have uplifted and taken these rocks, whirled them along from some centre of dispersion, and afterwards depositing them, as the velocity of the current became diminished by opposing obstacles or currents, in the order of size and specific gravity, beginning with the deposit of the largest and ending with the smaller pebbles and sand, which, being easier carried, were taken greater distances. In the concussion of opposing currents and mountain waves, rising, perhaps, like giants, to thousands of feet above the general level, rocks would be broken and torn from their resting places to be taken by the recession of the water, as a great wave carries out the shells and sand which it gathers within its power.

There is no question as to the former existence of a glacial period over parts of the earth now favored with a genial sun and luxuriant vegetation, or the fact that the glaciers have left indelible traces of their movements, and contributed in various ways to produce physical alterations in the land; but the same causes which brought about the glacial age in latitudes where none now exist, was itself the fruitful source and chief instrumentality for much the greater part of the phenomena found in those places and ascribed to glacial action. We do not see in what other way England and Scotland, as also North America north of latitude 35, could be subjected to an age of ice, except by an alteration of the position of the earth in the plane of the ecliptic and a corresponding change in the arctic and antarctic circles. Nor could this movement have been a slow and progressive change, since this would be inconsistent with a number of other equally unquestioned facts which no other than a sudden cosmic movement will so satisfactorily account for.

If in a change, in the angle of inclination to the ecliptic, there should be also more or less altera-

tion in the position of the axis in respect to the matter of the earth, and this does not seem improbable, the grandeur and sublimity of the convulsion would be increased by the filling out in one place and flattening in another, so to again assume the spheroidal form due to rotation.

Sir Chas. Lyell thought the movements of the earth by which the land has been submerged or elevated have been very gradual, not to exceed two and one-half feet in a century, and that the period since Wales first rose above the sea level until now is more than 200,000 years ; that periods of depression have been equally slow and regular ; that these elevations were caused by gradual contractions from within.

The apparent effect would be the same if, in consequence of gravitation, the rotation of the earth, and other forces co-operating, the water should recede from one hemisphere and rise in another. Such seems to be true, and the process is now going on—the water slowly subsiding from the northern and rising in the southern half of the world. The preponderance of land being in the northern hemisphere, it is probable the centre of celestial gravitation is within the northern

hemisphere. If, then, this recession of the water shall continue until the centre of gravity is transferred to the south, the earth will move round and there will be an inversion of position. The inclination of the axis may be more or less than now. We observe that between the planets there is no uniformity of position to the ecliptic, varying from vertical in Jupiter to 75 degrees in Venus. The existence of any land surface is probably due to the slow and constant operation of causes that, at long intervals of time, produce paroxysms co-extensive with the entire mass of the earth. It seems consistent with reason, as well as with the appearance of the land. The vast ranges and chains of mountains, the faults and contortions of the rocks and coal measures, indicate such spasmodic movements. But for this gravitation which is constantly lowering and leveling the land, depositing the solids in the sea, the water would in time cover the whole surface, and all land animals become extinct. Favorite theories to account for irregularities and mountain ranges found upon the earth are contractions within and volcanoes. The latter are local in action, and the eruptions of matter thrown out

affect limited areas. Active volcanoes are to the present day quite numerous, and have produced many structural alterations of surface throughout the world—as, for instance, the great earthquake in the island of Java in 1883, completely changing the hydrography of the straits of Sundé.

Figuier represents an active volcano by a mountain having a vertical opening in the center, running down through the earth's crust and connecting with a vast central mass of liquid fire, supposed to fill the whole of the interior of the globe. Earthquakes and volcanoes are intimately connected, being different phenomena springing from a common cause. This connection is not always apparent. The volcanic field is more limited and local than the disturbances occasioned by them. The fire and smoke of powder discharged from a cannon are confined within a narrow range, but the effect or concussion may be felt to a considerable distance; the heat produced by the oxidation of different substances within, and the resulting chemical changes that take place upon a large scale at varying depths by the introduction of air and water, the expansion finally bursting, either through some existing crater—

forming a new one—or else creating internal modifications in structure of such magnitude that the force of the movement may be felt over an extensive area. Tremblings may also be occasionally due to gradual depletion within, as by the escape of petroleum and gases during a long series of years, the earth eventually settling down to refill the place of those substances which have escaped. It is also worthy of observation, in this connection, that nearly all volcanoes are situated near the sea—it is questioned if there are any exceptions to this rule. Humboldt has shown that Jurullo and others form part of a series ultimately connected with the sea or large lakes.

Volcanoes, though often disturbing districts of considerable area, do not cause any material transfer of position in the ejected mass. The formation of limestone is constantly going on, and constitutes about one-seventh of the earth's supposed solid crust. This material, when decarbonized by internal heat, and afterwards slackening or expanding by contact with air and water, must find vent, and the severity of the shock and magnitude of the eruption must bear a direct relation to the extent and depths of the heated

mass below. Whether there is any connection with other volcanoes in the same range may be doubted, as the existence of others in the same chain of mountains may be because the same ranges will contain in different parts the same elements or conditions for the production of eruptions. Rocks and material other than such as may be subjected to similar chemical change by heat, are thrown out in the form of lava, eruptions usually occurring in widely separated districts and at long intervals apart. The effect is local, and not likely to ever be the cause of any general disturbance of the earth, or its movements. A volcano is but an eruption upon the skin or cuticle covering the central mass, and beneath which lies the primary unstratified rocks of the eocene age.

All natural agents have their functions and parts, separately or jointly, as factors in producing physical phenomena; the great year accounts for glacial periods within the limit due to the change of the earth's position in respect to the apsides, and may be a link in the chain of cause and effect; but is not the immediate cause of other phenomena directly connected with such changes? Any true hypothesis not only accounts

for the phenomena to which it relates, but is consistent with every fact, though only indirectly connected or a subsequent part in the same chain of events, and should involve no inconsistency with any other fact throughout the realms of universal nature, from whatever quarter it may come. All truth is consistent, however wide the field or distant the source. Immutable as the decrees of God, its author, conflict is impossible. The sudden alteration of the earth's position as a result of broken equilibrium and the diluvial movements which would follow, changing the arctic region from one point to another, accounts for much that seems otherwise inexplicable. Glaciers receive and transport to greater or less distances earthy matter and rock; but *is* it probable that the moraines and vast deposits of boulders and boulder clay have generally been so made? A glacier is slowly formed, and moves with an imperceptible motion. It receives earthy material and stones by occasionally being detached from some higher elevation, and, falling or rolling downwards, finds lodgment, and are covered up by new ice, thus becoming rigid and fixed as part of the mass, to remain until, the ice thawing, they

are quietly dropped. The rocks would be angular and rough. Such is not the fact. They are smoothed and rounded—almost spheres in shape. They show evidence of having been violently rolled in sand, water and earth, permitting attrition one with another, as castings are polished until, finding quieter water, they were precipitated along with other material.

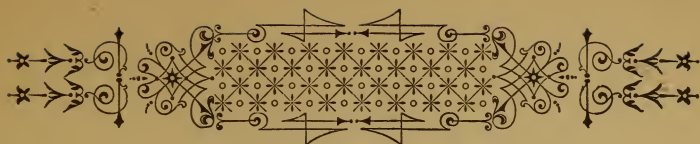
“Before the glacial theory was adopted, Swedish and Norwegian geologists speculated on a great flood, or the sudden rush of an enormous body of water, charged with mud and stones, descending from the central heights or water-shed, into the adjoining lower lands. The erratic blocks were supposed in their downward passage to have smoothed and striated the rock surfaces over which they were forced along.”—*Lyell's Antiquity of Man*, p. 233.

Periods of heat and refrigeration were alternated over the same parts of the globe—a warm, tropical climate has been succeeded by one of intense cold and a glacial age. To the agency of the latter, Agassiz, Lyell and others have attributed a greater share in the production of existing phenomena than analogical reasoning from ob-

servational facts would seem to warrant. And if so, the glacial theory must be restricted to at least only those effects which might be reasonably expected to follow the supposed conditions existing during an age of ice.

Professor A. H. Worthen, director of the geological survey of the State of Illinois, in vol. 7, p. 23, of his report, in his remarks upon the different strata found in sinking a coal shaft at Pana in that State, says: "One interesting feature of the superficial deposits here was the presence of two distinct forest beds or ancient soils—one three and a half, the other two and a half feet thick, and separated by fifty-seven feet of blue clay. One or both of these ancient soils have been found over a large portion of the State, and they present a serious obstacle to the land, ice or glacier theory of the origin of the drift deposits."





CHAPTER XII.

Petrified Forests—Corroborative Evidence—Fossil Remains—
Theories in Respect of—Pliocene Age—Animal Habits—
Ossiferous Caves—Fish Fossils—Aurignac—Kansas—Sub-
mersion.

ANOTHER fact which would indicate past diluvial convulsions, is found in the large number and position of erratic rocks scattered over many sections of the land in America, Europe and Asia, and still another is found in the petrified forests of Colorado, Arizona and other places. These rocks and forests furnish strong evidence of grand and great exhibitions of tremendous hydrostatic force, situations and effects that could hardly come from other than the rapid and violent movement of water.

In Colorado are found fossil remains of forests of large timber, originally standing and growing on the rich soil of the low lands and river bottoms,

now covered and incased in rock formed from the siliceous deposits of a deluge.

In the Yellowstone Park, Colorado, are found the remains of ancient forests completely silicified and enclosed in strata of sandstone, shales, breccia and fragmentary rock. Many of the trunks are twenty to thirty feet high, standing now as erect as when in the vigor of active growth, their roots in most cases imbedded in layers of fine-grained material, in which they grew; while the battered and branchless trunks are incased in the coarse conglomerates and breccias. These latter are composed chiefly of basaltic fragments, many of great size. There is, however, always enough tufaceous and other fine-grained material to fill the interstices and act as a cement.

Only the stronger trees of the forest have withstood the fierce storms of rocks, sand and water that must have prevailed at the period of their entombment, as the smaller trunks and branches are prostrate or totally destroyed. *

These fossil remains of large trees have not

* W. H. Holmes, U. S. Survey, 1879.

been covered with volcanic detritus, or been built around as they stood in comparatively shallow waters.

Such conditions are contrary to human experience and observation. They could not grow in water, or become petrified even to the bark and branches from heated scorïæ, as supposed by some authors.

But if, by some paroxysmal convulsion of nature, from contraction within or causes without, the earth and its aqueous covering has been in violent commotion, the oceans crossing and recrossing the land in great tidal waves, the forests occupying the alluvial bottoms and valleys with the adjacent hills and high lands to partially break the destructive force of the incoming waters, the detritus would finally incase the whole and preserve the heavier timber in its natural position. Nature has strewn far and wide the evidences or ear marks of such events; and though it may be we cannot say how many or how great the intervals in time between, or tell the immediate cause, it still seems in accord with existing phenomena and known principles or natural laws, that a change in the earth's centre of gravity, with a re-

sulting readjustment of matter and the earth's position in its orbit, has been the proximate cause and will best account for thermic changes; and the situation and preservation of both vegetable and animal fossil remains, as the same are now found in different parts of the world, the well preserved bodies, including the hair and outside coating of the animals, such as the *elephas primogenius*, a huge herbivorous tropical mammal, now found in Siberia and other high northern latitudes entombed in ice. The blood, flesh and tissues must have been frozen at the moment of death. Had they died in such a climate as they only could have grown and lived in, decomposition would have taken place, and no vestige now remain to testify to their former existence. They died in or near the place of their nativity, but that place was suddenly moved from near the equator and beneath a tropical sun towards the polar circle and a region of intense cold.

“The remains of the *elephas primogenius* were found in latitude 66 degrees 30 minutes north, so near perfect that even the eyes were preserved; and another carcase, found in latitude 75 degrees 15 minutes north, near the river Taimyr, was em-

bedded in strata of clay and sand, with erratic blocks, 15 feet above the sea level; in the same deposit was found the trunk of a larch tree, associated with fossil shells, characteristic of the drift period.”—*Lyell's Principles*, 7th ed.

In the history of British fossils, 1846, Professor Owen remarks :

“Although the molar teeth of the rhinoceros tichorrhinus present a specific modification of structure, it is not such as to support the inference that it could have better dispensed with succulent vegetable food than its existing congeners, and we must suppose, therefore, that the well clothed individuals who might extend their wanderings northward during a brief but hot Siberian summer, would be compelled to migrate southward to obtain their subsistence during winter.”

To suppose the elephant, rhinoceros tichorrhinus, hippopotamus, tigers, and other tropical animals were different in nature, wants and habits in former ages from what they now are in animals belonging to the same genera, or that in the past pliocene age they could inhabit high northern latitudes, subsisting on lichens, sea moss and

the scanty growth of a bleak climate, or that they were more migratory than now, spending their summers north and occasionally overtaken by a cold snap, seems hardly reasonable, unless by a parity of reasoning, we might also suppose pomegranates and bananas flourished upon the tops of icebergs and glaciers about the same time, and they have also since become indigenous to a warmer climate.

“The fossil remains of the mammoth, an animal twice as large as the elephant, are abundant in Siberia and Alaska, where their tusks are gathered as an article of export. This extinct race is now found perfectly preserved in the ice and frozen soil of the arctic regions. A specimen discovered at the mouth of the river Lena, and now at St. Petersburg, Russia, retained the hair and flesh, and every part in its natural condition. Wolves and other arctic animals fed upon the flesh. Its food consisted of leaves and branches of trees, and vegetables. They once existed in large herds, as also tigers, hyenas and other tropical animals.

“The mastodon, larger than the mammoth, also an extinct species of the quaternary period; its

food the coarsest vegetables, such as could only grow under a tropical sun. The fossil remains of this animal are abundant in the temperate zone of America, as in the higher latitudes of Asia, and belonged to different geological epochs.”—*Johnson's Cyclopaedia*.

Finding well-preserved remains of the mammoth, elephas primogenius, tiger, and other tropical animals in Siberia and other high latitudes, seems forcible evidence, not only of great, but sudden changes in the position of the earth in its ecliptic or in space.

These animals were natives of the land in which they perished. If the change from a warm tropical country and climate, as we know once existed there, had been by the slow gyratory motion of the poles—one complete revolution constituting the great year of over 20,000 years—the thermic change would have hardly amounted to so much as one degree in a century. All these animals would certainly have become extinct long before the climate became cold enough to prevent decomposition. This must also be true if the climatal changes had occurred from any other slow movement of the land. We see no

way to avoid the conclusion which we have drawn from the facts.

The fossil remains of animals, including those of man, and belonging to the pliocene and quaternary periods, are found in the gravel beds and pluvial deposits of the pliocene and post-pliocene age. These have been considered by Dr. Rigollett and Sir Chs. Lyell as satisfactory evidence of the antiquity of the race of man; but, not only the places, but the relations in which they are found, furnish presumptive proofs of some sudden and unexpected cataclysm which came upon all living creatures—a universal deluge and destruction of life.

In the gravel beds of Europe, England and America are found the bones of the mastodon, elephant, hyenas, whales, marine shells and crustacea in close proximity and confusion, occupying a common burial ground, and we do not doubt a common burial—facts scarcely possible had these animals been born, lived and died in the usual course of nature during the imperceptible evolution of a geological period.

That these and other post-pliocene deposits have been the result of sudden aberrations of the

globe and vast and terrific movements of the water upon its surface—movements whose sublimity and grandeur was like that when God said: “Let the waters under the heaven be gathered together unto one place, and let the dry land appear; and it was so.” The waters of the earth could not be gathered together, nor the dry land appear except in harmony with the laws of gravitation, for these are but the emanation and will of the Divine Spirit, in whom there is neither change nor shadow of turning. Such a convulsion of the aqueous matter on the earth would destroy the lives of all pre-existing creatures, and leave them in inextricable confusion, covered by the detritus of the great waves and currents speeding from one portion of the globe to another like the water in a vessel which is tilted first one way and then the other. A sudden aberration or movement of the earth would move the lines of latitude and longitude, the position of the earth in the plane of the ecliptic, and mark the end of an old world the beginning of a new one.

By this theory we account for finding the fossil remains of different orders and genera in their present relations; of tropical animals in a frigid

climate, of changes of climate over the same and different parts of the earth, and other phenomena which has been as a riddle to the geological student.

Changes ascribed to the evolution of countless ages have been wrought in the time required to describe them.

The wisest of men hath said: "The thing which hath been is that also which shall be." As Nature's law—God's law—is unchanging and unchangeable, producing an endless round of cause and effect, like causes produce like effects, and like effects follow like causes; the principle, or Nature's laws, than which nothing is more certain or better settled, must be questioned, or else accept the conclusion as to the results to be expected upon the consummation of the project for making an inland sea of the great desert of Sahara.

Many facts, attested by writers upon geology and the natural sciences, without reference or thought as to their bearing upon and corroboration of the hypothesis as to past or future floods, furnish the strongest presumptive evidence of the truth of the theory that such events have and will again visit the earth.

Others again, recognizing the unquestioned existence of fact and phenomena, have attempted to account for them upon theories inconsistent and artificial—the offspring of a fertile imagination.

Some of the strongest presumptive proofs of past submersions are found in the position and environment of fossil remains.

“Cuvier states that the mastodons, discovered near the great Osage river, were almost all found in a vertical position, as if the animals had died standing in mud.”

“A mastodon disinterred at Long Branch, New Jersey, was found standing and in a vertical position, as if he had wandered into a swamp in search of food and had died on the spot.”

“If the nature of the animal induced it to search for food in such situations as we find their bones, those that sunk in the mud or died there would be preserved, while other animals, having no inducement to go into those places, would leave no evidence of their existence. The bones of other animals, and even those of mastodons, when left in situations exposed to atmospheric influences, and as a prey to smaller gnawing

animals, would be destroyed, and no vestige of them would remain. This we know to be true from the fact that, although the country has been long inhabited by moose, deer, bears, wolves and smaller animals, yet rarely are any of their remains found."—*Jus. Hall, Geology of New York*, p. 365, v. 4.

It is not supposed these animals died in the usual course of nature from age, for in that case they would be nearly always found couchant, and not levant or standing. Nor do we regard the hypothesis reasonable that they wandered into a quagmire or bog in search of food and were unable to extricate themselves. Though no theory may be demonstrated, yet the one which does least violence to the known habitat of an animal must be the most probable. We had as soon expect to find an animal of the feline race diving for clams, as a huge herbivorous grass eater, the *elephas primigenius*, or the mastodon going into a swamp in quest of food.

The mastodon, and his congener, the elephant, is noted for intelligence, as well as his habits of feeding upon firm ground. An elephant, when required to cross a bridge, will first exam-

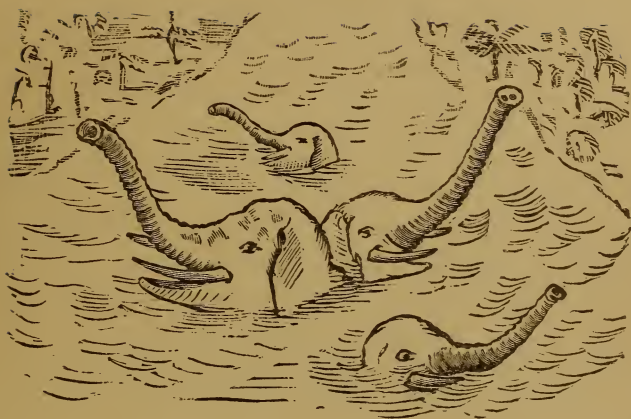


Fig. 3. *Elephas Primogenius* in search of food.

ine and try its strength by stepping lightly, before venturing his ponderous body upon it. These fossil remains, now so abundantly found in North America, were ante-diluvians ; living at the time of the last flood, they met their fate in the common disaster which had overtaken them and all other living creatures in whatever situation and wherever they happened to be at the time of being overwhelmed. It is probable such an event was immediately preceded by great disturbances and indescribably terrific sounds, and that all animals sought shelter. The very large animals resorting to lower rather than higher ground.

In the ossiferous caves and gravel pits in France, England and Wales are found the fossil remains of both living and extinct races of post-pliocene animals, including those of the human race. These are found thrown together indiscriminately, occupying the same caves and deposits—ante-diluvian animals that perished in these caves.

“The remains of the rhinoceros, hyena, tiger, bear, hippopotamus, horse, ox, elephant and other animals, including man, are found in vari-

ous caves in Europe and England. In the cavern at Kirkdale the great number of hyena teeth induced Dr. Buckland to suppose it had been a den of extinct hyenas, and that the other remains were the bones of animals which had been brought in as prey, and that they were suddenly exterminated by the eruption of muddy water into the cave, burying the hyenas and their victims in an envelope of mud."—*Reliquæ Diluviana*.

"It will be apparent that the bones in the ossiferous caves may either have been chiefly collected by predaceous animals, or have fallen into them from openings in the ground above, or drifted into them, or be the remains of mammals which have entered and died in the caves. * *

* That men have at various times inhabited caves and used them as tombs is well known, and is shown by the remains of the woman at Paviland.

"If man had been a cotemporary inhabitant where these extinct carnivora roamed in search of food, he might, as well as other creatures, have formed a portion of such prey."—DE LA BECHE, *Geology*, p. 302.

Whilst there is no question as to the facts stated in the quotations from the eminent French geologist, M. De La Beche, we do not think his theories as to how the remains found their way into these ossiferous caves the most probable. And we give these and other quotations from distinguished and learned authors as evidences of the facts stated, and not as approving in some instances the various theories proposed as to how these animals came to be there.

So, too, the fossil remains of fish are found in the oolitic rocks, and petrified in siliceous material in which, when soft and plastic, or held in suspension by water, these fish were enveloped. So, also, are found the fossil remains of whales far inland, thousands of feet above the sea. But we do not know that whales were ever suspected of being amphibious. They are found in the same deposits with land animals, which, to us, is an evidence of the operation of forces that made companions of different animals without regard to the element in which they had lived.

“Multitudes of fossil fish are found in rocks, that their sudden destruction seems needful in order to account for the mode of occurrence, it

appearing also necessary that their entombment was sufficiently rapid to prevent the destruction of their harder parts after death. * * * The study of the old fresh and sea bottoms presents the occurrence of animal remains, preserved as if by the sudden influx of water charged with fine matter in suspension; large numbers seem thus to have been destroyed."—DE LA BECHE, p. 515.

In the cave near Aurignac, in the department of the Haut Garonne, the opening into which was discovered by chance by a laborer chasing a rabbit which took refuge in a small opening that was found to lead into this natural excavation or terrene cave, within this cave, and near to the entrance, was found the fossil remains of seventeen persons of different ages, also the bones of bears, wolves, elephants, buffaloes, horses, reindeer, polecats, and other kinds of animals, both herbivorous and carnivorous. Sir Charles Lyell supposed these caves were used for burial purposes, and that the bones of the animals were the relics of funeral feasts. Such may have been the case, and the reason for finding the fossil remains of animals, but we think it improbable, as we do not see clearly how a people possessing no more



Fig. 4. Vertical section of cave near Aurignac, showing the position of human and other animal fossils.

effective weapon than a flint arrow head or a stone hatchet could kill and capture such an animal as the mammoth or *elephantis primogenius*, an extinct species more than twice as large as any now living, or transport him whole if they had succeeded in so doing ; nor does it seem more likely they could induce so intelligent an animal to voluntarily come to be barbecued for the consolation of surviving friends. But when it is inferentially alleged that these post-pliocene people used polecat in place of curry powder, for these are also found, we respectfully but firmly decline to adopt the obituary theory, and believe a great wrong has been done to the memory of these early pioneers of the human race.

If a Kansas farmer rushes into a cyclone cave at the approach of a summer cloud, we can readily perceive the inducement, not only for man, but animals also, to seek cavities in the earth and other places of supposed safety during great paroxysmal convulsions of nature.

If the Kansas farmer and family should be covered up and perish, after ages finding the outlines of the excavation and his fossil remains,

would pronounce him a cave dweller; or, his traits and habits being inferred from the *locus a quo*, he might be described as a sort of marsupial homo. If his favorite dogs and cats were also included in the deposit, the difficulties would be augmented, and his memory in danger of irreparable injury from the theories of the coming scientist.

. Besides the fossil remains in ossiferous caves, there are also found in gravel beds and other pluvial deposits the remains of both land and marine, living and extinct orders of animals, and the same strange companionship between man and the huge herbivora and carnivora of the period, as in the caves and openings into which he and his cotemporaries had fled in the vain hope of finding from within protection against the storms without.

It is not without at least a small amount of diffidence that we propose, or even suggest, theories at variance with the conclusions of others; but as every hypothesis must stand upon its reasonableness and merit rather than the name and fame of its author, we venture to assign other causes to account for some of the phenomena

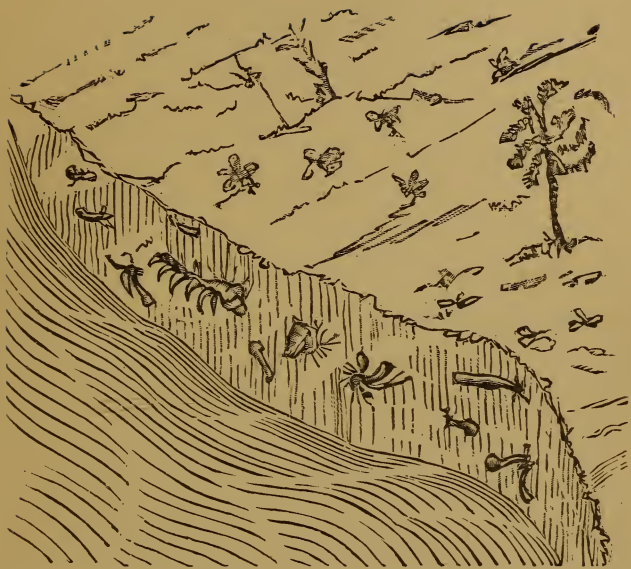


Fig. 5. Vertical section of gravel and drift deposits, showing the partly exposed remains of different animals, including man.

presented by the geography and geology of the earth.

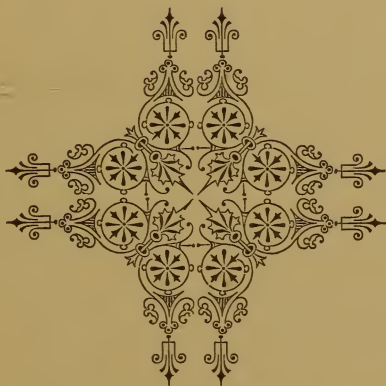
Moraines drift and striæ are found further south than latitude 40 degrees. An age of ice and refrigeration has, at no very remote period, doubtless extended as far south as the temperate zone of North America. A sudden cosmic change of position moved the poles and equatorial line, all other changes followed progressively in the order of cause and effect. The slow processes of a change, requiring thousands of years, fails to account for many facts as unquestioned as that of a glacial period. A sudden change in the earth's centre of gravity must be followed by a corresponding change in the earth's position toward the sun, and a change of all terrestrial lines; the earth would be swept over by tidal waves; mountains of water rising in one place and subsiding in another; glaciers, ice, and rock-ribbed mountains would be crushed and crumbled beneath the cataclysm; valleys filled; rivers disappear and all living creatures buried indiscriminately, so deep and remote from the influence of air and water as to be preserved for ages to come.

The fossil remains of a mastodon have been

recently found in their natural position forty feet below the surface near Riverside, San Bernardino county, California. This animal lived when the country enjoyed a tropical climate, and before the cold period which succeeded to it. Had he lain down to die in the ordinary course of nature in such a climate as he only could exist in, his flesh would have decomposed and his bones been separated and scattered widely apart long before in the ordinary course of nature he would have been covered over. If such instances were few they might be attributed to a cloudburst, cyclone or sudden freshets.

Many such fossil remains are so situated and environed in beds and caves as to exclude a reasonable doubt that, whilst living, they were suddenly and without warning engulfed in a sea of moving water, carrying a large amount of sand, gravel and rock held in suspension by movements of great force and velocity; by far the greatest number of creatures, large and small, were ground to atoms, and all possibility of identification destroyed; whilst by a headland, range of hills or other obstructions creating counter currents or eddies in the water, a few of them sunk and were

covered in the resulting detritus ; others may have found caves and openings in which they sought safety ; into these rushed animals of various sizes and kinds, including man. The lords of creation, carnivorous and herbivorous animals, in the presence of a common danger, forgot their habits and occupied the same resorts only to meet a common fate.





CHAPTER XIII.

Coal Measures.

NO single geological feature of the earth, or fact, perhaps, presents greater internal evidence of recurring floods at different periods over the earth than the coal measures. They contain not only evidence of the former existence of a tropical climate within the present arctic circle, as shown by the carbonized vegetable growth from which they have been formed, but furnish presumptive proof of the violence and rapidity in movement of the immediate cause to which their present existence is due, as well as evidence that such events have been of repeated occurrence at long intervals of time apart.

Each geological age had its deluge, and hence its coal measures, which may be distinguished from an earlier or later formation. Each of these measures are found upon such parts of the earth

as at the time possessed a tropical climate, heavy forests of timber and heavy vegetable growth.

Geologists classify the coal measures according to the age and the time when they began to be formed.

In the beginning of each geological age the areas possessing a cold or tropical climate have been changed, and, as one consequence, the coal measures belonging to any age are mostly found upon certain areas that at the beginning of the age possessed the conditions for heavy timber and rank vegetation. Thus the coals of a particular age are mostly found only in certain districts or parts of the earth.

“The coal measures, which form part of the Paleozoic or oldest of the three great geological divisions, are mostly found in countries north of the equator. The Mezzozoic is more abundant in the southern hemisphere, while the tertiary coal is more uniformly distributed.”—*Encyclopedia Britannica*.

With a rapid abnormal movement of the earth, the waters of the ocean would be carried inland, and rushing over hills and valleys bear down all vegetable matter, compacting and covering it in

places, and in others perhaps scattering it far and wide. Movements of the land would intensify those of the water, and in the grand whirl and rush of everything, the dense wood and vegetable growth of the torrid and temperate zones would be borne down and compacted by the overlying detritus in all conceivable shapes and at varying depths, where, by the exclusion of sun and air, and the lapse of ages, this timber and vegetation has been converted into coal.

The great coal fields of America and other scarcely less areas in other parts of the world attest the variety and exuberance of vegetable growth preceding its destruction and submersion beneath a sea of moving waters, earth and sand. When, in course of time, another and similar event occurs, the new growth will be covered there to remain concealed until converted into carbonized oxygen; the previous formations will be faulted and broken, with different dips, according to the movement of the subjacent parts. When the earth shall experience another deluge, the timber and vegetation of the temperate and torrid zones will form the basis of new measures, to remain until brought forth to increase the com-

fort and improve the condition of perhaps a new and better race of intelligent beings.

Brown coal, lignite and peat beds belong to the quaternary age, and are of recent formation. The density and tropical luxuriance of vegetation, which would form coal veins of 10 to 25 feet in thickness, may be imagined, and must have greatly exceeded anything now found in any part of the globe.

No considerable coal formation can occur from materially different causes; it could not be by mere growth and decay upon the surface; the vegetable fibre would be reconverted into alluvion.

Timber isolated or covered by sedimentation becomes silicified—as in the petrified forests of California and Arizona. The character and effects of volcanic action are such that they could not aid in the creating of coal, but more likely to destroy than to create the necessary conditions.





CHAPTER XIV.

Primordial Age—Age of the World—Deluged at Different Times.

IN the primordial age of the world the mobility of the material permitted the arrangement of its elements according to specific gravity. The whole exterior surface was one boundless expanse of water. There was but one ocean, and, outside of this, the atmosphere. The moon revolved at the distance of only a few thousand miles, and in proportionately less time than now, the tides rose and fell ten or twenty times as high, and the air was filled with vapor and clouds. It was truly void and without form. Terrific storms and ocean currents swept over the face of the deep. In the comparatively quieter waters of the temperate and frigid zones began the shoaling of the bottom and gradual deposits of material, and in time the dry land rose above the sea. Earthquakes, storms and tides contri-

buted to increase and modify the area above the sea until living creatures began to occupy the older and more stable parts.

How long a time was required to develop the first continent or to bring the earth to its present condition can not be told with mathematical certainty ; but in the creation a thousand years is as but a day. Some have supposed that since the earth assumed a separate existence as an individual body millions of years have passed away. Camille Flammarion, a French astronomer, speculating upon the age of the earth, says : "The primordial age alone, during which incipient life was represented only by algæ, crustaceans, and vertebrates, as yet without a head, appears to have occupied $\frac{5.3}{100}$ of the time that has passed from the epoch at which the earth became inhabited up to our day.

"The primary period which succeeded it is typified by the establishment of coal, vegetation and fishes, and appears to have occupied $\frac{3.1}{100}$. The secondary period, during which splendid coniferous plants predominated in the vegetable world, enormous saurians reigned over the animal kingdom, lasted the following $\frac{1.2}{100}$. The

earth was then peopled by fantastic beings that were perpetually at war with each other. The tertiary period, during which we see the advent of mammiferæ and animal species exhibiting more or less physical affinity with the human race. Its duration was less than $\frac{3}{100}$.

“Finally, the quaternary age witnessed the birth of the human species, and represents less than $\frac{1}{100}$ of the total time.

“Allowing only 100,000 years to the quaternary, the age of present nature, the tertiary would be 300,000; the secondary, 1,200,000; the primary, 3,000,000, and the primordial more than 5,000,000; total, 10,000,000.”

A further speculation of this eminent scientist and author is, that after the earth was thrown off from the sun, of which it constituted a part, 350,000,000 years were required to reduce its temperature to 200 degrees, but does not state how many millions more would be required to reduce it to about 70 degrees, the probable maximum of the possibility of organic life.

In the judgment of this writer, notwithstanding some difficulties, the only cosmogonic theory admissible is that which represents the plan-

ets as having been successively detached from the sun's equator, at the epoch in which this star was only a nebulæ stretching far out, as the present orbits of the planets.

However we may speculate as to the age or origin of the earth, it is reasonably certain that, since it became fit for the habitation of mammals, it has been deluged at different times, the immediate cause being a change in its centre of gravity, and a readjustment of position to bring it again in harmony with exterior attraction, caused, it may be, by meteoric additions to one hemisphere, or by the slower transfer of matter from one hemisphere to the other, or from one section of the globe to another.





CHAPTER XV.

Beginning and End of Epochs—Improved Race of Animals—
End of Man—New Race—New Earth—End of the Quaternary Age of the World.

SINCE living creatures began to exist upon the earth, great paroxysmal diluvial convulsions have successively marked the end of an epoch and a lower order of animals, and the beginning a new age and a higher order of life, until man himself received the breath of life and became a living soul, and was given dominion over the earth and over the fish of the sea, over the fowl of the air, and every living thing that moved upon it.

In every age or epoch of the world many races of the previous age have reappeared, as well as such new orders as were peculiarly the product of or fitted to the new and improved earth and the new conditions of animal existence. With regard

to the various changes which have unquestionably taken place at different times, the astronomer Dr. Thos. Dick says :

“Another conclusion deduced from the antiquity of the materials of which the earth is composed, is that during the changes which the globe has undergone since its original production, several destructions and subsequent new creations of animals and plants have taken place, perhaps at very different and very distant epochs. The greater part of geologists conclude that four or five epochs of destruction and renewal may be traced in the organic remains contained in the different strata; in other words, that whole groups have been swept at once from existence by some powerful catastrophe, and their places supplied by other races called into existence by the creating energies of the Almighty. The records of geology seem to testify that such was the condition of the globe in those early periods as to temperature and other circumstances, that our present races of animals could not have then existed, and that such was the nature and constitution of these primeval beings that they could not exist in the present constitution and circum-

stances of our globe, their natures being adapted to the different conditions of the earth at different periods of its existence.

“A further conclusion is, that the successive changes to which our globe has been subjected have been improvements in its condition as a habitable world. That there has been a correspondent advance towards perfection in the natures of the animals and plants which have been placed upon its surface, and that the Deity, during this long period of successive changes was gradually fitting up this world for the residence of moral and intellectual beings, such as the human species. It appears next to certain that the race of men could not have inhabited this globe in any of the past periods of its duration prior to that era in which he was placed upon it. It would appear that Deity prepared a suitable habitation for man by the agency of those laws which he impressed upon the elementary principles of the material universe in the beginning.”—THOS. DICK, LL D., *Geo.*, p. 74.

“It appears that every successive general change that has taken place on the earth’s surface has been an improvement of its condition.

Animals and plants of a higher order have been multiplied, with every change, until at last the earth was prepared for existing races, with man at their head, the most generally perfect of all."—EDWARD HITCHCOCK, D. D., *Geology*, p. 231.

If we may draw from these facts any conclusion as to future events, it would seem to be, that when man has made all the improvement the present earth in its relations to his animal and spiritual economy will permit, there will then come an end to the quaternary period, or the age of man, and the earth will again be prepared anew for a new and still more advanced order of intelligent beings.

There is a limit beyond which, in physical improvement and moral and intellectual progress, man, in his present state and with his present surroundings, cannot go. Doubtless many will differ widely as to where this limit may be found. But we may be now facing the outer line of this utmost limit. Take a retrospective view of all that has been accomplished. Consider the rapid, almost startling progress made during the last five hundred years in the arts and sciences and human inventions, especially the rapid advance

of the last century, it seems almost incredible to even the people who have themselves been actors in this last act in the drama of human life; to all others, were they now living, the marvellous development would be as a fairy tale too wonderful for human credulity. The printing press, by which knowledge has increased and books been multiplied; steam power, in all its strange and wonderful applications; railroads, and the iron horse; transportation, with the velocity of winged couriers of the air; telegraphs and telephones, annihilating time and distance; tunneling through mountains; uniting distant seas; all these and more have been accomplished by man. It would seem there can be but a limited range beyond.

Of the several projects for isthmian transit between the Atlantic and Pacific oceans, that of the Tehuantepec Ship Railway is the least expensive and most practical. It involves none of those dangerous geographical changes in land and climate, which the author of *Man and Nature*, or physical geography modified by human action, supposed at least possible upon making an open waterway between the two oceans.

With the completion of one or more of these

projects, there will remain no other of great moment save the inundation of Sahara. Man may have reached practically the limit or goal of his animal existence ; with his present environment no further progress being possible until a new and regenerated earth, with a new and better and differently constructed race of beings, with a new physiological and mental development, having a frame adapted to either locomotion or flight, a nearer insight into the arcana of the Creator, a physical and moral constitution in harmony with universal good ; when such organisms shall occupy and possess the land, then a new earth will afford fresh fields for higher and nobler achievements, greater opportunities for the conquest of mind over matter, the spirit over the flesh, the assimilation of man to his Maker, this will be the beginning of a new epoch and a new day in the endless progression of creative energy.

Recognizing the improvement and the physical and mental attributes of man as well as the noble and ignoble uses made of them, we think there is ample room between the present race and angels for an intermediate race of animals superior to man, and believe that in the progressive order of nature it will be occupied.

In the event a great flood should prepare, renovate and improve the earth ready for the occupation of a better and more intelligent race of beings than those that now inhabit it, it might not be regarded as an evil unmixed with good. Of course we do not know what others may think; it is a question for each to determine, and, if willing to accord an equal right to all, there can be no occasion for complaint.

Prior to the Noachian deluge the earth was fertile and productive, and we may well suppose that, in peopling the earth and perhaps other globes with inhabitants, the Creator intended to give a display of His perfections to beings capable of contemplating it, and to promote their sensitive and mental enjoyment. Accordingly we find that, when man was first placed on this globe, everything that was beautiful to the eye and the imagination, and pleasant to the taste, was prepared for his accommodation and comfort. The waters were separated from the dry land, the earth was adorned with verdure, rivers and refreshing streams flowed around him to increase his pleasures, trees and plants and flowers of every hue embellished the landscape; with the sun and

moon to radiate light and warmth, and the myriads of celestial luminaries as a canopy to adorn his habitation and elevate his contemplation to other worlds in his Creator's dominions, every tree and plant yielding delicious fruit to gratify his taste; with perpetual springtime and a constant succession, there was no occasion to labor or lay up stores. With obedience and love as the only conditions of his happiness, he was given the will to obey or disobey; for without this it would have been but a senseless exhibition of power to create man as an automaton who could neither act nor do other than certain prescribed performances—he would no longer be an intelligent, rational being as distinguished from the inferior races of animals.

In the course of time the descendents of Adam and Eve became numerous, spreading out over the land, some living a nomadic life with flocks and herds, and others congregating in towns and cities, and engaged in the enjoyment of the passions and pleasures of the hour.

Of the exact state of the arts or progress of learning and diffusion of knowledge, we have no historical account, but suppose they had not

reached the limit of man's capacity except in wickedness: "For God saw that the wickedness of man was very great, that every imagination of his heart was only evil continually," and to give them a further opportunity for improvement, if happily they should embrace it, the race was not cut off entirely by the Noachian or last flood.

If, when the earth shall be destroyed again, it shall be universal, and all creatures now inhabiting the earth shall become extinct, and the earth renewed and fitted up for the abode of a better and higher race of beings; whether the reproduction shall begin with the lower animals, continue progressively upward until the highest are brought into existence, is beyond human ken to even surmise. But whether by gradual evolution or otherwise, whether as an immediate act or fiat of the Creator, or the necessary result of law impressed by the same power over matter, is known only to Him who has created the heavens and the earth and all things therein, whose ways are above man's ways as the heavens are above the earth, and altogether past finding out.



CHAPTER XVI.

Conclusion.

IN presenting our views or conjectures as to the probable results to be expected from the conversion of Sahara into an inland sea, nothing more was designed or intended than to very briefly present our conclusions, with some facts and corroborative evidence of past convulsions, together with the reasoning in part from which they were drawn, so as to present them, as well as we could, for the consideration of others. Our object has not been to simply furnish a book for the amusement of others and our own benefit, but to present a fact of supreme importance in its several relations to human welfare, as we understand it. We have not taken imaginary facts or principles and clothed them in the garments of truth and

soberness, as De Foe, Poe, Swift and others have done. We are not equal to such an effort, and whatever of interest may attach will not be in consequence of the literary character of the performance.

We make no claim to a knowledge superior or even equal to that of many.

Every fact in nature and every principle in physics, upon which we have predicated the views and opinions presented, are open to all, and, as we suppose, recognized and accepted by all. We have not attempted an imaginary description or picture of the consequences and changes likely to occur in the paroxysmal convulsion which would follow the inundation of Sahara should our calculations and theories prove correct.

Were we so disposed, we would still hesitate at an effort in which the most active imagination, coupled with profound knowledge and gifted intellect, must needs fall far short of the reality; where the dullest mind may supply more than sufficient to excite the gravest apprehension as to the magnitude of the changes to be apprehended, and may as easily supply any omission on our part.

If others reach other and different conclusions from a consideration of the question, as to the probable result to be expected from the submersion of so large a part of the earth's surface, by the transfer of so much water and weight, we trust the proofs and reasonings may be so clear and self-satisfying as to leave no ground for debate or doubt.

Though we are free to acknowledge possible errors in the statement of phenomena or fact, and of principles and their application, if it should be so in any matter affecting the question of future diluvial convulsions, it can bring no shade of regret to us, though it may also add ours to the long list of exploded theories that have gone glimmering in the light of later discoveries. We may remark that it is instructive to note and reflect upon the variety and number of scientific theories in almost every field of human knowledge, which, after being accepted for generations, have been discarded, and given place to others, some of which may in time share the same fate.

According to Ptolemy, the learned astronomer, the earth was fixed or stationary, and the sun and planets revolved around her. This was believed in the middle of the 15th century.

Aristotle believed and set forth in his twelfth book of *Metaphysics* that the heavenly bodies were ensouled and that each moved in his orbit by a conscious volition.

The most eminent of English astronomers, Sir W. Herschell, supposed the exterior surface of the sun to be peopled with inhabitants.

Madler believed the star Alcyon to be the central sun of the universe; others, equally learned, say it is a groundless speculation only.

It is affirmed that there is in fact no evidence that the stellar universe is held together by any bond of attraction, as our solar system is, a fact, if true, proving that the principle of rotation and gravitation are not universal, though it is not questioned as to the solar system.

The moon is held a dead, barren uninhabitable world by some, and by others the contrary is affirmed.

As to the cosmogony and destiny of the planets, including the earth, there are different theories, though not more than one can be true.

The same phenomena in nature gives rise to conflicting theories; for instance, the red sun sets during the present year, 1884, as also the question, What is electricity?

Whilst such facts may prove human fallibility of judgment, it can not be taken as any argument against scientific methods or affect the general value of theories until shown contrary to reason. Seeing the company we may get into, we, the more readily, acknowledge the possibility of error and our own fallibility of judgment.

On the other hand, if the author's theories as to possible results to be expected from the inundation of Sahara shall be believed sound, he will be entitled to at least some favorable consideration for calling attention to the subject in time to avoid so great a calamity ; for, if true, it will be too late to correct the error, or retrace mistaken steps after being once taken. If not true, if he is wrong, no harm can result from their publication, being only his individual convictions from the lights before him as herein set forth, not as forcibly as they might have been ; but such as they are he submits them to the reader.

SAN DEIGO, CAL., Nov. 1st, 1884.



NOTE.—ADDENDA TO PAGE 80.

On page 80, and in other parts of this book, the observations as to the probable phenomena from the submersion of the Desert of Sahara are chiefly in respect to the movements of water ; but it is certain that in such an event meteorological, electrical and other phenomena of equal greatness, grandeur and sublimity, as those of land and water, would follow a paroxysmal movement of the earth. That during such a paroxysm an electrical storm of fire would prevail over all, enveloping the whole atmospheric cover of the earth in its embrace, as in a sheet of flame.

During such a paroxysm in the rapid currents, movements, cross movements, and collisions of air, land and water, the earth would become a dynamo or electrical machine of unknown power.

The sharp flashes and detonations given out during a volcanic eruption, or the rapid frictional

development of electricity under a moderate summer wind, gives but a faint idea of the electrical forces that would be developed during a terrestrial convulsion or paroxysm. In the last day, when *"The heavens shall pass away with a loud noise, and the elements shall melt with fervent heat,"* it will be by the sudden liberation of forces existing potentially within the globe itself.





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